4. ENVIRONMENTAL CONSEQUENCES

This section analyzes the potential impacts to human and environmental resources resulting from construction and demonstration of the proposed CFB combustor project and for three reasonably foreseeable scenarios of no action. Potentially affected physical, biological, social, and economic resources are included. The analyses for no action focus on a comparison of impacts with those anticipated for the proposed project.

4.1 ENVIRONMENTAL IMPACTS OF THE PROPOSED PROJECT

4.1.1 Land Use and Aesthetics

4.1.1.1 Land Use

The proposed project would slightly change existing land use, which would not result in major adverse impacts. A total of approximately 75 acres of land would be required on the Northside Generating Station and adjacent St. Johns River Power Park property, including 5 acres of land for the proposed power block (Figure 4.1.1). This parcel of land for the power block is partially grassed and has some temporary buildings and sheds that are used to store equipment. Part of this land also has been paved and is used as a covered parking lot for employees. Much of the land already has been disturbed to some extent because of the presence of vehicular traffic and its proximity to the existing units. The 40-acre ash storage area in the northwest corner of the property would require harvesting of approximately 28 acres of pine plantation and loss of 10 acres of upland hardwood/pine habitat (Section 4.1.6.1) and 1.8 acres of isolated hardwood wetland habitat (Section 4.1.5.3). Much of the 10 acres of land for the covered solid fuel storage pile under Option 2 is currently being used as a dredge spoil area (Figure 3.4.2). Under either option, no more than about 10 acres of Power Park land would be required.

The proposed project would be constructed to minimize impacts to the number, density, and species types of trees. As a mitigation measure, the planting of trees to replace those removed during construction is required under the city of Jacksonville's tree protection regulations. JEA would supply replacement trees from their tree farm to the local civic association for the latter to use wherever needed to implement the community's beautification program. As part of the proposed project, JEA is planning to enhance the landscaping at the entrance to Northside Generating Station and extend landscaping along Heckscher Drive adjacent to the Northside property. JEA would plant 20 mature date palms, other trees, shrubs, and ground cover.

Implementation of the proposed project would not require any land off the Northside Generating Station site for water treatment or sewage treatment. All construction facilities and laydown/staging areas would be located on the site. Construction and operation of the repowered units would be consistent with existing use.

The proposed project would not alter the pattern of land use in Duval County because it would be confined to the existing Northside and Power Park property. The proposed project would be

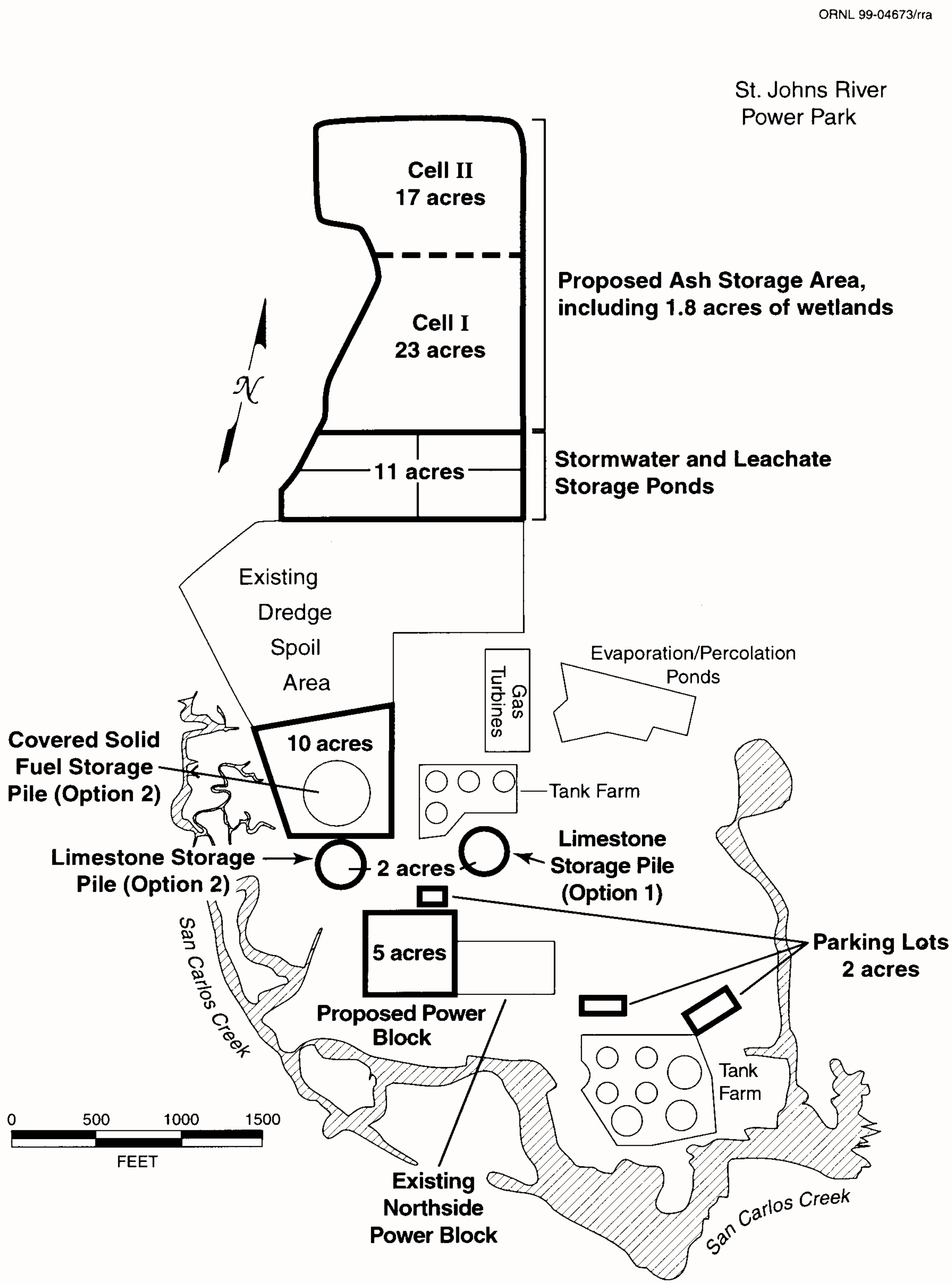

Figure 4.1.1. Principal land requirements for the proposed project at Northside Generating Station.

consistent with existing land use plans and local zoning. Furthermore, any in-migration of workers that might occur during project construction and operations would not be large enough to increase the amount of land used for residential purposes (Section 4.1.9.3) or public service facilities (Section 4.1.9.5). Although some indirect and induced jobs would be created as a result of direct employment at the project site (Section 4.1.9), any increase in the amount of land devoted to commercial purposes in Duval County would be extremely small.

4.1.1.2 Aesthetics

As part of the proposed project, JEA would construct a single 495-ft twin-flued stack at Northside Generating Station. This new stack would be considerably taller than the two existing stacks (250 ft and 350 ft tall), so it would be visible from a greater distance. However, it would be nearly 150 ft shorter than the stack at the adjacent St. Johns River Power Park and is much smaller in diameter than the Power Park's two 425-ft hyperbolic cooling towers, so it would not be the most highly visible feature in the area. Moreover, three stacks existed at Northside Generating Station until the 300-ft stack for Unit 2 was dismantled and removed in early 1998. As part of the related action of repowering Unit 1, the existing 250-ft stack would be dismantled and removed. The new CFB combustor buildings for each of the repowered units would be similar in size to the existing combustor and turbine buildings. If JEA were unsuccessful in marketing the ash generated by the proposed project, the height of the 40-acre ash storage area would reach 100 ft in 9 to 11 years (Section 5); however, this mound of ash should not be aesthetically displeasing and would be consistent with the area's industrial character. In general, the proposed project would not alter the industrial appearance of the site and, accordingly, would not degrade the aesthetic character of the Northside site and the surrounding area.

More specifically, the visual impact of the proposed project would be very minor on the Timucuan Ecological and Historic Preserve, located along the eastern border of Northside Generating Station (Figure 2.1.2). The Kingsley Plantation, Fort Caroline National Memorial, Ribault Monument, and Theodore Roosevelt Area are located within the Timucuan Ecological and Historic Preserve. Northside Generating Station is not visible from these four locations. There are two opportunities for viewing Northside Generating Station from the access road to the Kingsley Plantation, which is approximately 6 miles east of the station. These views are located in small open areas in the forested canopy along the dirt access road. The station is visible to people fishing in these areas. The duration of the viewing opportunity for people in moving vehicles is very brief.

The Federal Aviation Administration would make the final decision on the marking and lighting of temporary and permanent structures associated with the proposed project (Section 7.1). Generally, construction cranes and other elevated equipment require lighting if their height above the ground exceeds 200 ft. The 495-ft stack would require medium- or high-intensity flashing white obstruction lights. The lights would operate at reduced intensity during the night. Because this type of lighting is currently installed and operating on the Power Park's stack and cooling towers and on the Cedar Bay Generating Plant's stack, located about 2 miles west of the proposed facility, the additional lighting would be consistent with the area's industrial appearance and would not degrade the aesthetic character of the area.

4.1.2 Atmospheric Resources and Air Quality

Potential impacts to atmospheric resources may result from construction or operation of the proposed facility. Section 4.1.2.1 discusses effects of construction, which primarily involve fugitive dust associated with earthwork and excavation. Section 4.1.2.2 discusses effects of operation; these result from a wider variety of pollutants that have effects at varying time and space scales. An introductory subsection summarizes air emissions from operation of the proposed project. This introduction is followed by an analysis of potential degradation of air quality and an analysis of potential cumulative impacts to air quality. Topics covered in the remainder of the section include noncriteria pollutants that may cause human health effects, radionuclide emissions, effects on visibility, regional-scale acidic deposition, and global climate change.

4.1.2.1 Construction

During construction of the proposed facility, temporary and localized increases in atmospheric concentrations of oxides of nitrogen (NO_x), carbon monoxide (CO), sulfur dioxide (SO_2), volatile organic compounds (VOCs), and particulate matter would result from exhaust emissions of workers' vehicles, heavy construction vehicles, diesel generators, and other machinery and tools. Construction vehicles and machinery would be equipped with standard pollution-control devices to minimize emissions. These emissions would be very small compared to regulatory thresholds typically used to determine whether further air quality impact analysis is necessary.

Fugitive dust would result from excavation and earthwork. The impacts of this dust on offsite ambient air concentrations of particulate matter less than 10 μm in ***aerodynamic*** diameter (PM-10) were modeled using the EPA-recommended Industrial Source Complex Short-Term (ISCST3) air dispersion model (EPA 1995). An average emission factor of 1.2 tons of total suspended particulate matter per acre per month was assumed (EPA 1985). Of these emissions, roughly 30% of the mass would consist of PM-10 (Kinsey and Cowherd 1992). It was further assumed that sprinkling with water would reduce fugitive dust by 50% (EPA 1985) and that construction would occur during daylight hours only.

The maximum area undergoing heavy construction at any one time was assumed to be 10 acres. This includes the area on which the proposed CFB combustors and adjacent facilities would be located (extending from the existing Unit 3 west toward San Carlos Creek) and an adjacent area to the south to be used for short-term staging and other temporary activities. Equally large areas farther from the site boundaries may be disturbed at other times. However, pollutant concentrations from nonbuoyant ground-level sources decrease as distance from the source increases; therefore, disturbance of areas farther from the site boundaries would have less effect on offsite PM-10 concentrations. Also, disturbances in areas away from the site of the proposed combustor facilities are likely to be less intense.

Five years (1984–88) of meteorological data from Jacksonville International Airport (about 9 miles west-northwest of Northside Generating Station), in conjunction with upper-air data from Waycross, Georgia (about 70 miles northwest of Northside Generating Station), were used for this analysis of construction impacts. Jacksonville International Airport is the nearest location at which quality-assured hourly meteorological data are archived. Because meteorological data from 1980 for a location nearer to Northside Generating Station were not archived on an hourly basis, those data are inappropriate for air dispersion modeling. Comparison of wind roses at the two locations confirmed that meteorological data from Jacksonville International Airport are generally representative of conditions at the site of the proposed project (Section 3.2.1). The 5-year period for modeling analysis was based largely on the availability of continuous meteorological data in a form suitable for model input. Although there is no overlap between that period and the 5 years (1993–97) of recent air quality data used in the analysis (Table 3.2.1), data from the 1980s are still indicative of meteorology in the region; however, air quality may have changed, which makes it necessary to use recent air quality data.

Waycross, Georgia, provides the nearest upper-air data; these data represent large-scale meteorological conditions and would therefore be expected to be relatively uniform between Waycross and Jacksonville. However, in coastal areas, some meteorological parameters may change appreciably as one moves closer to or away from the coastline. On warm and sunny days, when the land surface can be much warmer than the ocean surface, the height above ground to which convection causes appreciable vertical mixing (the mixing height) is typically highest over inland areas and decreases nearer the coast. In such cases, the mixing height at Northside Generating Station would tend to be lower than indicated by the upper-air data at Waycross; however, mixing heights at both locations would be high, favoring dispersion of pollutants and, correspondingly, lower pollutant concentrations. Under such conditions, vertical dispersion of fugitive dust would not be affected at locations near the source, such as the nearest site boundary or nearby offsite locations. Therefore, differences in mixing height between Northside Generating Station and Waycross would not affect the results.

Concentrations of PM-10 were modeled in each of 36 directions (at 10-degree intervals) in 328-ft increments from the center of the disturbed area. Maximum existing emissions of PM-10 from stacks at Northside Generating Station and the St. Johns River Power Park were included in the modeling to simulate construction activities occurring simultaneously with operation of the existing facilities. The total concentrations, obtained by adding maximum modeled concentrations to their corresponding background concentrations (Table 3.2.1), were compared with the NAAQS. Because construction emissions are temporary, the comparisons made in Section 4.1.2.2 with PSD increments were not made for construction activities.

During any major construction activity, it is typical that PM-10 concentrations exceed the NAAQS near the edge of a disturbed area; in this case, results indicated that exceedances of the 24-hour standard could occasionally occur up to 1,200 ft from the nearest edge of the construction area if construction were as intense as that assumed in the modeling and lasted from 7:00 a.m. until 7:00 p.m. No exceedances would be expected at any residences because the nearest residences are approximately 1,600 ft southeast of the existing turbine building. No exceedances of the 24-hour standard would be expected as far south as the St. Johns River, and no exceedances of the annual standard would be expected at distances greater than about 300 ft from the nearest edge of the construction area.

Construction also would be required under the two options for the solid fuel delivery and handling system (Section 2.1.3). Option 1 is to construct a second unloader at the existing St. Johns River terminal on Blount Island, which is outside the site boundary; Option 2 is to construct a new solid fuel and limestone unloading terminal at the existing Northside Generating Station fuel oil unloading dock, which is adjacent to, but also outside of, the site boundary. For each option, emissions of fugitive dust from construction activities were modeled using the same approach as above, except that the construction area was assumed to be 2 acres with dimensions of 420 × 210 ft, and no buffer area was assumed to exist between the construction area and the receptors (i.e., locations at which air quality effects were modeled). Emissions factors for fugitive dust were the same as those used previously. Results indicated no exceedances of the annual or 24-hour NAAQS for PM-10 at distances beyond 500 ft from the nearest edge of the disturbed area. Therefore, no exceedances would be expected at any residences or other locations likely to be frequented by a member of the general public.

4.1.2.2 Operation

This section discusses potential air quality impacts resulting from operation of the proposed facility. New emissions of air pollutants would occur primarily from the 495-ft twin-flued CFB combustor stack. Table 4.1.1 summarizes annual emissions and maximum potential hourly emissions of SO_2, NO_x, and PM-10 from the existing and proposed units at Northside Generating Station. Specifically, Table 4.1.1 compares existing air emissions from Units 1 and 3 with emissions expected during the transition period after the Unit 2 repowering (the proposed project) and emissions expected after the Unit 1 repowering (the related action). Although the capacity factor for the repowered Units 1 and 2 would be 90% (Table 2.1.1), Table 4.1.1 uses a 100% capacity factor as an upper bound that matches the PSD air permit application.

The table shows that the repowering of Unit 2 and a corresponding reallocation of emissions among the three units would meet JEA management’s target of a 10% reduction in annual emissions

Table 4.1.1. Comparison of existing air emissions at Northside Generating Station with emissions expected during the transition period after the Unit 2 repowering and emissions expected after the Unit 1 repowering

Operating units	Fuel	Generating capacity (MW)	Capacity factor[a] (%)	Sulfur dioxide (SO_2) tons/year	Sulfur dioxide (SO_2) lb/hour[b]	Oxides of nitrogen (NO_x) tons/year	Oxides of nitrogen (NO_x) lb/hour[b]	Particulate matter (PM-10) tons/year	Particulate matter (PM-10) lb/hour[b]
				Existing emissions					
Unit 1	Oil and gas	297.5	39	5,528[c]	5,479	1,716[c]	1,231	394[c]	346
Unit 3	Oil and gas	564	34	8,121[c]	9,965	2,284[c]	1,510	585[c]	629
Station total		861.5		13,649[c]	15,444	4,000[c]	2,741	979[c]	975
				Expected emissions during the transition period after the Unit 2 repowering[d]					
Unit 1	Oil and gas	297.5	30	522	397[e]	1,046[f]	1,231	244[f]	346
Repowered Unit 2	Coal and coke	297.5	100[g]	1,833	419	1,100	251	135	31
Unit 3	Oil and gas	564	34	9,929[f]	9,965	1,454[f]	1,510	503[f]	629
Station total		1,159		12,284	10,781	3,600	2,992	882	1,006
				Expected emissions after the Unit 1 repowering[h]					
Repowered Unit 1	Coal and coke	297.5	100[g]	1,833	419	1,100	251	135	31
Repowered Unit 2	Coal and coke	297.5	100[g]	1,833	419	1,100	251	135	31
Unit 3	Oil and gas	564	42	8,618[f]	9,965	1,400[f]	1,510	612[f]	629
Station total		1,159		12,284	10,803	3,600	2,012	882	691

[a]Capacity factor is the ratio of the energy generated during a period of time (12 months in this table) to the energy that would be produced if the equipment operated at its maximum power during that entire period.

[b]Maximum hourly emissions, based on using 100% fuel oil for the existing units (nearly independent of fuel type for the repowered units because emissions controls would be adjusted based on fuel type).

[c]Average of the 1994 and 1995 estimated actual values. Permitted emissions for Unit 1 are 23,997 tons per year of SO_2, 5,393 tons per year of NO_x, and 1,515 tons per year of PM-10. Permitted emissions for Unit 3 are 43,648 tons per year of SO_2, 6,613 tons per year of NO_x, and 2,756 tons per year of PM-10.

[d]Based on the expected schedule, the transition period would span from March 15, 2002, until March 15, 2003; the repowered Unit 2 would be brought online on March 15, 2002, and the existing Unit 1 would be taken offline on September 15, 2002, to complete the construction required for its repowering.

[e]Derived by calculating the maximum hourly emissions from Unit 1 that would result in maximum downwind concentrations less than all ambient air quality standards; a blend of natural gas and fuel oil with an SO_2 emission rate averaging no more than 0.143 lb/MBtu would be required.

[f]Derived by calculating the maximum annual emissions from Unit 3 or Units 1 and 3 that would achieve a 10% reduction in annual stack emissions from Northside Generating Station compared to existing emissions (based on the average of the 1994 and 1995 estimated actual values).

[g]Although the capacity factor is expected to be 90%, this comparison uses a 100% capacity factor as an upper bound that matches the air permit application.

[h]Starting on March 15, 2003, based on the expected schedule.

of each pollutant (SO_2, NO_x, and PM-10) from the three units collectively while at the same time increasing Northside's total generating capacity. The related action of repowering Unit 1 would allow that unit to operate a greater percentage of the time and consequently increase the total annual energy output of the station while maintaining the overall 10% reduction in annual SO_2, NO_x, and PM-10 emissions. Annual emissions from Units 1 and 3 (during the transition period after the Unit 2 repowering) and from Unit 3 (after the Unit 1 repowering) would be adjusted by using different blends of natural gas and fuel oil to meet the overall 10% reduction. Thus, the relationship between annual emissions and capacity factor is not proportional. For example, as indicated in the table, annual SO_2 emissions from Unit 3 would decrease after the Unit 1 repowering from 9,929 to 8,618 tons per year because more natural gas and less fuel oil would be used, even though the capacity factor would increase from 34% to 42%.

The combination of the proposed project and the related action would also reduce maximum potential hourly emissions from the three units collectively. Maximum hourly SO_2 emissions would decrease by 30% after the Unit 2 repowering and would remain essentially unchanged from that lower level after the Unit 1 repowering. This reduction results from a commitment by JEA to use a blend of natural gas and fuel oil with an SO_2 emission rate averaging no more than 0.143 lb/MBtu (effectively, a blend with a sulfur content averaging no more than 0.13%) in Unit 1 during the transition period. Maximum hourly emissions of NO_x and PM-10 would increase somewhat after Unit 2 is repowered because emissions from Units 1 and 3 would remain the same while emissions from Unit 2 would be added. Emissions would then decrease after the Unit 1 repowering; the net result compared to existing maximum hourly emissions at Northside Generating Station would be a decrease of 27% in NO_x emissions and 29% in PM-10 emissions.

In addition to the emissions summarized in Table 4.1.1, relatively small amounts of pollutants would be emitted from the 75-ft stacks serving the proposed limestone dryers. Maximum potential hourly emissions of NO_x from those stacks would be about 1% of NO_x emissions from the repowered Unit 2; hourly emissions of SO_2 and PM-10 would be even smaller percentages compared to Unit 2. Emissions from the dryers were conservatively assumed to be at their maximum hourly rate during the transition period after the Unit 2 repowering and to continue at that rate after the Unit 1 repowering.

Although emissions of SO_2, NO_x, and PM-10 from Northside Generating Station would decrease as a result of the proposed project and related action, the redistribution of pollutants in the atmosphere is a complex process that could result in increased ground-level concentrations at some locations and for some averaging periods. On any particular day, concentrations could be increased at some locations and decreased at others; at any particular location, concentrations could be increased on some days and reduced on others. Because emissions from the proposed limestone dryers would occur close to ground level, as compared with emissions from the boiler stacks, concentrations of pollutants emitted from the dryer stacks would be expected to increase near the site boundary; these increases would be greatest for NO_2 because NO_x emissions from the dryer stacks exceed those of other pollutants. Thus, concentrations could be increased slightly near the site boundary while decreased at other locations.

Sources of air pollutants other than stacks would include plant vehicular traffic and personal commuter vehicles; this small amount of traffic would not contribute appreciably to ambient air pollutant concentrations in the area, and therefore is not included in the following analysis. Additional PM-10 would be generated from handling and transfer of coal, petroleum coke, and limestone at the site. To reduce these PM-10 emissions to acceptable levels, the proposed project would minimize the number of handling and transfer points, enclose the conveyors and material unloading points, use wetting systems for particulate suppression, and install collection devices such as baghouses. Air quality effects of these emissions are not included in the following analysis, but results of the evaluation in the PSD air permit application (JEA 1999) indicate that handling and transfer of materials would not generate particulate emissions that would exceed 85% of ambient air quality standards at the location of maximum impact outside the site boundary.

DOE ***has performed a conformity review to assess*** whether a conformity determination (40 CFR Part 93, Subpart B) is needed ***for*** the proposed project. Currently, no portion of Duval County is designated as a nonattainment area for any NAAQS or Florida standard, but Duval County is a maintenance area for O_3 (Section 3.2.2). A maintenance area is an area that previously was a nonattainment area for a pollutant and which is striving to maintain attainment with the standard(s) for the pollutant and comply with the state implementation plan. However, a conformity determination is not required [40 CFR Part 93.153(d)] because the precursors of O_3 (VOCs and NO_x) are evaluated in the PSD permit application (JEA 1999). Because emissions of these pollutants would be greater than PSD significance thresholds [40 CFR Part 93.153(b)], the application includes Best Available Control Technology analyses for these pollutants.

The following analysis first evaluates the changes in ambient air concentrations of pollutants expected to result from changes in stack emissions associated with the proposed project alone and in conjunction with the related action (PSD subsection); then the analysis examines potential cumulative air quality impacts from the proposed facility and from other regional sources (NAAQS subsection).

Prevention of Significant Deterioration

As discussed in Section 3.2.2, PSD increments are established to restrict the deterioration of air quality that could result from new pollutant sources (40 CFR Part 51.166). PSD increments are used in this analysis as standards by which to measure the significance of the changes in ambient air concentrations. There are two PSD Class I areas within 63 miles of Northside Generating Station (Section 3.2.2). All other areas are designated as Class II.

Proposed project. The ISCST3 atmospheric dispersion model (EPA 1995) was used to estimate maximum increases in ground-level concentrations of SO_2, NO_2 and PM-10 that would occur at any location as a result of emissions from the CFB combustor and limestone dryers for the proposed project (the Unit 2 repowering). Meteorological data were the same as those used for the analysis of construction impacts in Section 4.1.2.1. Maximum potential hourly emissions and a 100% capacity factor were used in the modeling. All NO_x emissions were conservatively assumed to be in the form of NO_2 for comparison with the NO_2 increment. Concentrations were modeled at 352 locations (receptors) along or outside the property boundary (boundary of the combined area occupied by Northside Generating Station and the adjoining St. Johns River Power Park) at distances of up to 6 miles from the proposed CFB combustor stack. For short-term averaging periods, PSD regulations allow for one anomalous exceedance of an increment per year (40 CFR Part 51.166); therefore, the highest modeled short-term concentrations at each receptor location for each year were excluded, and the highest remaining values for all 5 years modeled (1984–88) were included in the analysis.

Results indicate that maximum modeled increases are always less than 15% of their corresponding Class II increments (Table 4.1.2). Maximum concentrations generally occur at locations along, or very close to, the site boundary, often within 0.6 mile of the proposed CFB combustor stack. Because the nearest PSD Class I areas are more than 30 miles from the proposed facility (Section 3.2.2), pollutant concentrations estimated by the ISCST3 air dispersion model for those locations would be overly conservative. Dispersion of pollutants at such distances would reduce atmospheric concentrations to only a small fraction of the maximum modeled increases near the site. Because these maximum modeled increases are about equal to (for short-term SO_2 and annual NO_2 concentrations) or less than PSD Class I increments at the locations of their maximum impact near Northside Generating Station, the increases in pollutant concentrations at the nearest PSD Class I areas would be expected to be only small fractions of the corresponding Class I increments (Table 3.2.2).

Proposed project and related action. The combination of the proposed project and related action would result in emissions from the new 495-ft twin-flued stack that would be twice those considered in the analysis of the proposed project alone. However, emissions from the stacks serving the proposed limestone dryers were assumed to be at their maximum value for the proposed project alone and were not increased in the analysis of the proposed project in conjunction with the related action. Furthermore, the elimination of emissions from the existing 250-ft stack serving Unit 1 would more than compensate for the added emissions. Compared to existing emissions at Northside Generating Station, a net decrease in maximum hourly emissions of SO_2, NO_x, and PM-10 would result from the addition of the repowered Unit 2 and the limestone dryers and the replacement of the existing Unit 1 with the repowered Unit 1 (Table 4.1.1). Therefore, a decrease in ground-level

Table 4.1.2. Prevention of Significant Deterioration (PSD) impact analysis for the proposed project and for the related action of repowering Unit 1

Pollutant[a]	Averaging period	PSD Class II increment[b] ($\mu g/m^3$)	Proposed project: Modeled increase ($\mu g/m^3$)	Proposed project: Percentage of PSD Class II increment	Proposed project in conjunction with related action: Modeled increase ($\mu g/m^3$)	Proposed project in conjunction with related action: Percentage of PSD Class II increment
SO_2	3-hour[c]	512	27	5	30	6
	24-hour[c]	91	6	7	6	7
	Annual[d]	20	0.4	2	0.3	2
NO_2	Annual[d]	25	3	12	3	12
PM-10	24-hour[c]	30	0.7	2	0.7	2
	Annual[d]	17	0.06	< 1	0.06	< 1

[a]SO_2 = sulfur dioxide; NO_2 = nitrogen dioxide; PM-10 = particulate matter less than 10 μm in ***aerodynamic*** diameter.

[b]PSD increments are standards established in accordance with the Clean Air Act provisions to limit the degradation of ambient air quality in areas in attainment of the National Ambient Air Quality Standards.

[c]For averaging periods less than 1 year, one exceedance per year is allowed (40 CFR Part 51.166); therefore, the highest modeled concentration for each year has been excluded, and the highest of the remaining concentrations over the 5-year period is given.

[d]The maximum modeled annual concentration is used.

concentrations of these pollutants would be expected most of the time at most locations in the surrounding area.

However, pollutant concentrations would not decrease for all averaging times at all locations; maximum ground-level concentrations at some locations could increase because the characteristics and location of the proposed new stack would be different from those of the stack currently serving Unit 1. For example, the presence of a scrubber would result in a lower exit temperature for the exhaust gas from the new stack. This would tend to decrease the buoyancy of the exhaust gas, lower the height of the pollutant plume, decrease the vertical and horizontal spread of the plume, and increase ground-level concentrations. On the other hand, exhaust gas from the repowered Units 1 and 2 operating simultaneously would be emitted from adjacent flues, which increase the initial upward momentum and buoyancy of the exhaust gas. This larger initial lift would result in a greater plume height, a greater vertical and horizontal spread of the plume, and lower ground-level concentrations than would occur otherwise. The net result would be a complex redistribution of pollutant concentrations near Northside Generating Station. The net impacts could be positive or negative on any particular day at any particular location, but negative impacts would be expected to be less than the upper-bound estimates presented in this analysis.

Maximum modeled increases in ground-level concentrations for the proposed project in conjunction with the related action are very similar to those for the proposed project alone. Maximum increases are always less than 15% of their corresponding Class II increments (Table 4.1.2). This result is largely attributable to the dominance of the proposed limestone dryer stacks in determining maximum concentrations. Although emissions from the limestone dryer stacks would be less than 1% of emissions from the proposed twin-flued CFB combustor stack, the maximum modeled concentrations of the former are comparable to, and frequently larger than, maximum concentrations of the latter. Because the dryer stacks would only be 75 ft tall, they would be subject to strong aerodynamic effects from surrounding structures. Under frequently occurring meteorological conditions (e.g., neutral atmospheric stability and moderate or high wind speeds), these effects could cause maximum impacts from the dryer stacks, which would occur about 500 ft from their source, to be larger than maximum impacts from the CFB combustor stack, which would occur several miles from their source.

Because the nearest PSD Class I areas are more than 30 miles away, pollutants from Northside Generating Station would be well mixed in the atmosphere, and stack characteristics would have little effect on ground-level pollutant concentrations in these areas. Therefore, a net decrease in pollutant emissions resulting from the proposed project in conjunction with the related action (Table 4.1.1) would be expected to improve air quality, albeit by a very small amount, at the nearest PSD Class I areas.

Complete PSD analysis for regulatory applications considers other sources in the area that may be contributing to the degradation of air quality (40 CFR Part 51.166). However, expected effects of the proposed facility alone and in combination with the related action are small fractions of the corresponding PSD increments at locations close to Northside Generating Station (Table 4.1.2), and would be even smaller fractions of those increments at locations distant from Northside Generating Station. Similarly, pollution increments attributable to other sources would have their maximum values near their respective sources, and would be unlikely to approach 100% of PSD increments near the site of the proposed project. Therefore, other sources in the area were not included in this PSD analysis but were included in the modeling of cumulative effects discussed in the following subsection.

The foregoing discussion of air quality impacts near Northside Generating Station focused primarily on maximum degradation. Improvements would also be expected to result from the decrease in air emissions that would accompany implementation of the proposed project in conjunction with the related action (Table 4.1.1). Maximum modeled improvements in air quality were obtained by simultaneously modeling the emissions from the proposed CFB combustor stack and limestone dryer stacks with the elimination of emissions from the stack currently serving the existing Unit 1. Maximum improvements in air quality would occur at different times, and typically at different places, than would maximum degradations. Modeled maximum improvements and degradations are compared in Table 4.1.3. The improvements would generally be much greater than the degradations, reflecting primarily the net emissions decrease.

Table 4.1.3. Maximum improvements and maximum degradations in air quality that were modeled to result from the proposed project in conjunction with the related action of repowering Unit 1

Pollutant[a]	Averaging period	Maximum improvement ($\mu g/m^3$)	Maximum degradation[b] ($\mu g/m^3$)
SO_2	3-hour[c]	157	30
	24-hour[c]	42	6
	Annual[d]	3	< 1
NO_2	Annual[d]	1	3
PM-10	24-hour[c]	3	< 1
	Annual[d]	< 1	< 1

[a]SO_2 = sulfur dioxide; NO_2 = nitrogen dioxide; PM-10 = particulate matter less than 10 μm in ***aerodynamic*** diameter.

[b]Same as the modeled increase shown in Table 4.1.2 resulting from the proposed project in conjunction with the related action of repowering the existing Unit 1.

[c]For averaging periods less than 1 year, one exceedance per year is allowed (40 CFR Part 51.166); therefore, the highest modeled concentration for each year has been excluded, and the highest of the remaining concentrations over the 5-year period is given.

[d]The maximum modeled annual concentration is used.

In conclusion, concentrations of SO_2, NO_2, and PM-10 would be expected to increase by only a small fraction of their respective PSD increments as a result of the proposed project. Actual degradation of air quality should be even less than the relatively small amounts presented above as upper-bound estimates. When the related action of repowering Unit 1 is also considered, beneficial effects on air quality would be expected to outweigh the small adverse effects.

National Ambient Air Quality Standards

Pollutants for which National Ambient Air Quality Standards (NAAQS) exist (criteria pollutants) include SO_2, NO_2, CO, Pb, O_3, and PM-10 ***(Section 3.2.2)***. Concentrations of CO are of primary concern near major intersections in large cities, where the simultaneous idling of many vehicles can produce a large ground-level source, and air circulation is limited by surrounding high-rise buildings. Concentrations of CO in downtown Jacksonville were always much less than their corresponding NAAQS during the 5-year period of analysis; therefore, CO emissions from the proposed project were not evaluated further. No appreciable Pb emissions would occur from operation of the proposed facility. Concentrations of Pb in recent years have been well below NAAQS (Table 3.2.1), largely because of the decreased use of leaded gasoline in automobiles. Therefore, the remainder of this section addresses O_3, SO_2, NO_2, and PM-10.

Ozone. O_3 is not emitted directly from a combustion source; instead, it is formed from photochemical reactions involving emitted VOCs and NO_x. Because the reactions involved can take hours to complete, O_3 can form far from the sources of its precursors (the VOCs and NO_x that initiate its formation). Therefore, the contribution of an individual source to O_3 concentrations at any particular location cannot be readily quantified.

The proposed project and the corresponding decrease in emissions from Units 1 and 3 would result in a 10% decrease in NO_x emissions from Northside Generating Station (i.e., 400 tons per year) (Table 4.1.1), or less than 1% of the NO_x emissions in Duval County. Meanwhile, VOC emissions would increase by 61 tons per year (Table 2.1.1), or by less than 1% of VOC emissions in Duval County (including biogenic emissions). It is not clear whether the net effect of increasing one O_3 precursor (VOCs) and decreasing another (NO_x) would tend to increase or decrease O_3 concentrations; however, because the magnitudes of the changes in precursor emissions are so small compared to regional values, the magnitude of any resulting change in O_3 concentrations is expected to be negligible.

The repowering of Unit 1 would not result in any additional change in the total annual NO_x emissions from Northside Generating Station (Table 4.1.1). Repowered Unit 1 would add 61 tons per year to the VOC emissions from Northside Generating Station, while the 24 tons per year currently emitted by the existing Unit 1 would be eliminated; the net result of the proposed project combined with the related action of repowering Unit 1 would be an increase of 98 tons per year (Table 2.1.1), or less than 1% of VOC emissions in Duval County. Therefore, the proposed project, either by itself or in combination with the related action, would be expected to have only negligible effects on O_3 concentrations.

There are 2 O_3 monitors in Duval County: one is located about 5 miles north-northwest of Northside Generating Station and the other is located at the Naval Air Station, about 15 miles southwest of Northside Generating Station. During 1993–97, O_3 concentrations at the nearest monitor were always less than 90% of the 1-hour NAAQS (Table 3.2.1); because changes in NO_x and VOC emissions from the proposed project alone or in conjunction with the related action would be less than 1% of emissions in Duval County, they would not be expected to lead to any exceedances of the 1-hour NAAQS for O_3 at that monitoring location. It is possible (although very unlikely) that the changes in emissions could lead to concentrations greater than the 1-hour standard at the Naval Air Station because the station recorded concentrations in the 1990s equaling that former standard. It is more likely, however, that the changes in emissions would have no detectable effect at the station. It is not yet possible to assess the effect of the proposed project on compliance with the 8-hour standard ***(Section 3.2.2)***.

Other criteria pollutants. Potential cumulative air quality impacts of SO_2, NO_x, and PM-10 emissions from the proposed facility and from other regional sources were evaluated by estimating maximum increases in ground-level concentrations using the ISCST3 air dispersion model (EPA 1995) with the same meteorological input data discussed in Section 4.1.2.1. Modeling included emissions from the proposed project and from the existing stacks at Northside Generating Station, the St. John River Power Park, and several other sources within 30 miles of the proposed project that were expected to contribute to cumulative impacts (e.g., Cedar Bay Cogeneration, Inc., and the Stone Container Corporation). Maximum potential hourly emissions and a 100% capacity factor were used in the modeling. All NO_x emissions were conservatively assumed to be in the form of NO_2 for comparison with the NO_2 standard. Concentrations were modeled at 352 locations (receptors) within 6 miles of the proposed CFB combustor stack excluding the Northside Generating Station and the St. Johns River Power Park properties. Maximum modeled concentrations during the 5-year period of meteorological data were added to the corresponding monitored background concentrations (Table 3.2.1), and the totals are compared to NAAQS or Florida standards, as appropriate, in Table 4.1.4.

The modeling of existing nearby sources assures inclusion of their effects on air quality near the site of the proposed project; these effects may not be fully represented at the nearest monitoring location because the instrument may be located relatively distant from Northside Generating Station. Adding monitored background concentrations to the modeling results assures inclusion of contributions from sources that were not modeled (e.g., natural sources, vehicles, and utilities or industrial sources that were not modeled because of their small size and/or large distance from the proposed facility). Adding modeled and monitored concentrations is conservative because it "double counts" any modeled effects that are included in the monitoring data. The use of maximum potential

Table 4.1.4. Ambient air quality standards impact analysis for combined effects of regional sources and the proposed project

Pollutant[a]	Averaging period	Standard[b] ($\mu g/m^3$)	Modeled concentration[c] ($\mu g/m^3$)	Ambient background concentration[d] ($\mu g/m^3$)	Total impact[e] ($\mu g/m^3$)	Total impact as a percentage of standard
SO_2	3-hour	1,300	478	236	714	55
	24-hour	260	199	52	251	97
	Annual	60	18	8	26	43
NO_2	Annual	100	6	30	36	36
PM-10	24-hour	150	26	66	92	61
	Annual	50	2	28	30	60

[a]SO_2 = sulfur dioxide; NO_2 = nitrogen dioxide; PM-10 = particulate matter less than 10 μm in ***aerodynamic*** diameter.

[b]National Ambient Air Quality Standards (NAAQS) except for annual and 24-hour averages of SO_2. The NAAQS are established in accordance with the Clean Air Act to protect public health and welfare with an adequate margin of safety. States may establish standards more stringent than NAAQS; Florida has established such standards for annual and 24-hour averages of SO_2.

[c]Maximum modeled concentration from existing regional sources including the proposed project.

[d]From Table 3.2.1.

[e]The sum of the modeled concentration and the ambient background concentration.

hourly emissions from all sources, rather than the smaller actual emissions, adds conservatism to analysis. Therefore, the estimates of total impacts and their percentages of corresponding standards in Table 4.1.4 represent upper-bound values; they could conceivably occur, but are higher than the amounts that would be expected.

Results of modeling regional sources and the proposed project indicate that no exceedances of national or state ambient air quality standards would be expected if the proposed project were implemented (Table 4.1.4). However, the 24-hour average SO_2 concentration would be 97% of the corresponding Florida standard, and all SO_2 concentrations would increase appreciably compared with the ambient background concentrations. Particularly for the short-term concentrations, these large values result from aerodynamic downwash effects caused by the proposed 200-ft tall combustor structure that would induce downward motion on the exhaust gas emitted from the 250-ft stack serving the existing Unit 1 and the 350-ft stack serving the existing Unit 3. Exhaust gas from the proposed 495-ft CFB combustor stack would not be subjected to substantial downwash because the stack is taller. Downwash leads to substantial, localized increases in ground-level concentrations near the site boundary compared with concentrations that would result from an identical situation without downwash. These effects are complicated; in general, maximum ground-level concentrations are redistributed as greater concentrations within about a mile of the source and smaller concentrations at greater distances (compared with an identical situation without downwash). During the 6- to 12-month transition period before the Unit 1 repowering, JEA has committed to reduce maximum hourly SO_2 emissions from the existing Unit 1 by nearly 93% when operations commence for the proposed project (Table 4.1.1). This reduction, which would be accomplished by using natural gas and fuel oil with a sulfur content averaging no more than 0.13%, would assure that the maximum 24-hour average SO_2 concentration would not exceed the Florida standard, as indicated in the modeling presented in Table 4.1.4.

Estimated SO_2 concentrations for other averaging periods are less than 60% of their respective standards. The annual average NO_2 concentration is less than 40% of the NAAQS. The 24-hour and annual averages of PM-10 are less than 65% of the NAAQS, even though ambient background PM-10 concentrations for both averaging periods are over 40% of the NAAQS.

Results of modeling regional sources and the proposed project in conjunction with the related action of repowering the existing Unit 1 indicate that maximum concentrations are always less than corresponding concentrations without the related action. For example, the 24-hour average SO_2 concentration for regional sources and the proposed project in conjunction with the related action is 91% of the Florida standard, compared to 97% for regional sources and the proposed project without the related action. This decrease is attributable to several factors. First, the repowered Unit 1 would emit pollutants through a 495-ft stack rather than the 250-ft stack serving the existing Unit 1. The taller stack would allow more dilution of the pollutant plume before it reaches ground level. Second, elimination of emissions from the existing shorter stack would be augmented by the corresponding elimination of aerodynamic downwash affecting those emissions. Third, although the Unit 1 repowering would increase the maximum potential hourly emissions from the twin-flued 495-ft stack by a factor of two, the exhaust gas would be emitted from adjacent flues, which would add buoyancy and upward momentum to the plume, so that ground-level concentrations of pollutants emitted from that stack alone would increase by much less than a factor of two. Finally, compared to the transition period after the Unit 2 repowering, the Unit 1 repowering would be accompanied by appreciable reductions in maximum hourly emissions of NO_x and PM-10; maximum hourly emissions of SO_2 would remain almost the same (Table 4.1.1). The net effect would be that expected maximum ground-level concentrations would decrease appreciably for NO_2 and PM-10 and would decrease slightly for SO_2 compared with the modeling performed without the Unit 1 repowering.

Human Health Effects from Noncriteria Pollutants

In addition to the criteria pollutants listed in 40 CFR Part 50, other contaminants are present in the atmosphere; however, their concentrations are typically very small and are therefore difficult to measure (Section 3.2.2). Nonetheless, even in very small concentrations some of these contaminants may be health hazards because of their toxicity and/or carcinogenic (cancer-causing) potential. Because of the lack of background measurements for most toxic substances in the atmosphere, the following analysis deals only with modeled ambient air concentrations resulting from the proposed project.

Two approaches were taken to estimate potential impacts of hazardous materials that would be released to the atmosphere from the proposed project alone. The first approach was based on EPA reference doses and carcinogenic potency concepts; it was applied generally (Appendix D) to several metals, organic compounds (including dioxins and furans), and acid gases (including hydrogen fluoride) that could be emitted in small quantities from the proposed project. In the second approach, two metals (beryllium and mercury) that may be emitted at significant rates (40 CFR Part 51.166) were further evaluated by comparing maximum modeled increases in atmospheric concentrations to Florida Ambient Air Reference Concentrations (FAARCs), which are guideline concentration values established to protect human health.

Both approaches were based on maximum modeled increases in ambient air concentrations obtained by applying the ISCST3 air dispersion model (in the same manner as for the criteria pollutants) to estimated emissions from the proposed project using coal or petroleum coke as fuel. Both approaches assumed that the project would be operating at a 100% capacity factor. Estimated emissions tend to be conservative (form an upper bound) because no control measures were assumed in calculating the emission rates. For both approaches, modeled concentrations are presented for the location of maximum impacts, about 1.6 miles east of the proposed project, near the southern boundary of the Timucuan Ecological and Historic Preserve. This location is different than the location of maximum impacts for the criteria pollutants because the limestone dryer stacks were excluded in this modeling, since they would have negligible emissions of these contaminants.

General analysis based on EPA reference doses and cancer-risk measures. Reference doses and cancer-risk measures are available for use in defining maximum ambient air concentrations of various substances for the protection of human health. Reference doses, which apply to noncarcinogenic effects, are available for most of the noncarcinogenic substances that would be emitted from the proposed facility (EPA 1989). These doses were used to calculate corresponding guideline values of maximum contaminant concentrations in the ambient air for the protection of human health, based on the assumption that air is inhaled at a rate of 26 yd^3 per day by a person weighing 154 lb. In some cases, only an oral reference dose was available and this was used without modification for the inhalation dose (i.e., 100% absorption was assumed); this procedure tends to overestimate potential impacts. Comparisons of the maximum modeled contaminant concentrations in the ambient air with their guideline maximum values for the protection of human health indicated that the concentration of chromium would be less than 2% of its guideline maximum value (its percentage of the EPA reference dose is 1.36 in the seventh column of Table D.1); for other substances, the corresponding percentages would be much less than 1% (Table D.1). These results indicate that the public would be adequately protected with respect to noncarcinogenic effects resulting from the proposed project.

Cancer potency slopes taken from EPA (1998a) were compared with the anticipated emissions of dioxins, furans, and other carcinogenic substances from the proposed project. Calculated risk values indicate that the cumulative cancer risk from inhalation would be less than 2 in 10 million per year (1.42×10^{-7} in the ninth column of Table D.1). Except for dioxins and furans (which are discussed specifically in the following subsection), the cancer risk from ingestion of these substances would be much less than 1 in 1 million per year. ***Cancer risk is consistently discussed in the EIS on a "per year" basis. Because the facility would be designed for a lifetime of 30 years, the risk from a 30-year period of exposure during the lifetime of the facility can be approximated by multiplying each corresponding annual risk by 30.***

Dioxins and furans. The health effects of dioxins and furans (which are closely related to dioxins in chemical structure and health effects) were included in the analysis of cancer risk. However, because dioxins were raised as an issue during public scoping, additional discussion of dioxins is presented below.

The production of dioxins and furans is of concern wherever fuels are burned, especially if a source of chlorine is present. There are 210 structurally related forms (congeners) of chlorinated dibenzo-*p*-dioxins (CDDs) and chlorinated dibenzofurans (CDFs), and several congeners are typically released from a combustion source. The dioxin-like compounds are often found in complex mixtures. To assist in risk assessment, a toxicity equivalency procedure has been developed to characterize the cumulative toxicity of these mixtures (EPA 1989). This procedure involves assigning individual toxicity equivalency factors (TEFs) to the 2,3,7,8 substituted CDD/CDF congeners. These TEF values are estimates of the toxicity of dioxin-like compounds relative to the toxicity of 2,3,7,8-TCDD, which is assigned a TEF of 1.0. Calculating the toxic equivalency (TEQ) of a mixture involves multiplying the concentrations of individual congeners by their respective TEFs. The sum of the TEQ concentrations for the individual congeners is the TEQ concentration for the mixture. If the TEQ is expressed as a mass of material produced per mass of coal burned (an emission factor) for a coal-fired utility boiler, it would typically be less than 0.84 lb per billion tons of coal burned (NATO 1988), which is less than 1 lb per 1,000 years of operation of the proposed project at full capacity.

The average daily intake of dioxins for people in North America is approximately 119 pg TEQ/day for all exposure pathways combined (EPA 1994). Ingestion of dioxins from meat and dairy products accounts for the vast majority of exposure (about 100 pg TEQ/day), while inhalation accounts for about 2.2% or 2.6 pg TEQ/day. By comparison, cigarette smokers receive exposure to approximately 10 pg TEQ per pack (EPA 1998b). Dioxin emissions from the proposed project would be similar whether the facility burns coal and/or petroleum coke (Table D.1). Results of calculations indicated an exposure to about 0.01 pg TEQ/day for the maximum exposed person, weighing 154 lb and inhaling air at a rate of 26 yd^3 per day. Thus, the proposed project would add 4 parts per thousand of TEQ exposure via inhalation (0.01 pg TEQ/day added to 2.6 pg TEQ/day).

The combined risk of cancer from inhalation of dioxins and furans emitted by the proposed project was calculated to be about 2 in 100 million (0.2 in 10 million) per year (1.87×10^{-8} in the ninth column of Table D.1). The total cancer risk from inhalation of dioxins, furans, and other carcinogenic substances emitted by the proposed project was calculated to be less than 2 in 10 million per year (1.42×10^{-7} in the ninth column of Table D.1).

With regard to the ingestion pathway, specific source-receptor relationships are not well known for dioxins. Because dioxins attach primarily to very small particles, most dioxins are deposited far from their sources. However, because there is agricultural land in the Northside vicinity (including a dairy about 2 miles north-northwest of Northside Generating Station), an estimate was made that links the ingestion pathway for dioxins with air emissions from the proposed project. This estimate conservatively assumed that agricultural land such as the dairy would be exposed to the maximum modeled concentrations (even though the location of the maximum modeled concentrations, 1.6 miles east of the proposed project, is not agricultural land). The estimate also assumed that dioxins in milk and meat produced on the agricultural land would increase proportionally to the increase in airborne dioxins and that a person would consume 100% of his or her meat and dairy products from that land.

In North America, the average human intake of dioxins and furans is roughly 40 times greater via ingestion than inhalation (for dioxins, about 100 pg TEQ/day versus about 2.6 pg TEQ/day). Consequently, the ingestion of dioxins from the proposed project's emissions would be approximately 40 times the value of 0.01 pg TEQ/day for inhalation by the maximum exposed person, or 0.4 pg TEQ/day. Considering both ingestion and inhalation, the daily intake of dioxins resulting from the proposed project would be 0.41 pg TEQ/day.

The total cancer risk from inhalation and ingestion of dioxins and furans emitted by the proposed project was calculated to be about 8 in 10 million (0.8 in 1 million) per year (7.7×10^{-7}) by multiplying 1.87×10^{-8} (in the ninth column of Table D.1) by 41 to account for both inhalation (1.87×10^{-8}) and ingestion (40 times 1.87×10^{-8}). The sum of the cancer risk from inhalation of dioxins, furans, and other carcinogenic substances (1.42×10^{-7} in the ninth column of Table D.1) and from ingestion of dioxins and furans (40 times 1.87×10^{-8}) was calculated to be about 9 in 10 million (0.9 in 1 million) per year (8.9×10^{-7}). Given the upper-bound assumptions in the estimates, the risks would probably be less than these values.

Beryllium and mercury. Except for mercury emissions from burning petroleum coke, the proposed project could emit more beryllium and mercury (Table 4.1.5) than the amounts specified as significant in 40 CFR Part 51.166 (0.0004 tons per year for beryllium and 0.1 tons per year for mercury). In addition, mercury was raised as a pollutant of concern during public scoping. Therefore, further analysis is presented for these metals.

Table 4.1.5. Beryllium and mercury concentrations predicted to result from the proposed project compared with Florida Ambient Air Reference Concentrations (FAARCs)

Element	Fuel type	Emissions (tons/year)	Maximum 24-hour average concentration (NG/m^3)[a]	Maximum 24-hour average concentration as a percentage of FAARC
Beryllium	Coal	0.008	0.02	0.5
	Petroleum coke	0.003	0.01	0.2
Mercury	Coal	0.10	0.28	1.4
	Petroleum coke	0.02[b]	0.06	0.3

[a]Nanograms per cubic meter; a nanogram is 10^{-9} grams, or one billionth of a gram.
[b]Emissions were not significant (40 CFR Part 51.166).

Beryllium is listed as a known carcinogen (cancer-causing substance) by the American Conference of Governmental Industrial Hygienists (ACGIH) (ACGIH 1997). It can also have chronic noncancerous effects such as berylliosis (noncancerous growths in the lungs) and acute effects which primarily affect the lungs. Mercury can cause ulceration, particularly within the digestive system, liver, and kidneys. Mercury may also disrupt endocrine function, which is of particular significance during fetal development and early childhood, when organ development is most rapid.

Ambient air quality standards do not exist for beryllium and mercury; guideline concentrations are typically obtained either by back-calculating from EPA reference doses (Appendix D) or by adjusting time-weighted (8-hour) averages specified by ACGIH (1997) as maximum allowable concentrations for healthy workers, as follows. The first adjustment to the standards for healthy workers is made because they typically spend an average of 40 hours per week at their workplace rather than 168 hours (around the clock); therefore, the maximum allowable concentration for workers is divided by 4.2 (168/40). The resulting concentration is then divided by 10 because the tolerance of an individual during their years as a healthy adult worker would be greater than for their entire lifetime, especially during childhood and old age. The resulting concentration value is divided again by 10 to account for differing sensitivities to environmental exposures experienced by members of the general population, including the infirm. The final result is a guideline maximum ambient air concentration; for concentrations below the guideline value, it is expected that the public would be protected from adverse impacts. Such guideline values (sometimes referred to as "no-threat levels") are commonly used as maximum permissible ambient air concentrations of substances regulated by 29 CFR Part 1910.1000 (Patrick 1994b); for beryllium and mercury, they are given in this analysis as 24-hour average FAARCs.

Maximum modeled ambient concentrations of beryllium and mercury that would result from the proposed project are compared to the FAARCs in Table 4.1.5. Beryllium concentrations would be less than 1% of the corresponding FAARC. The mercury concentration would also be less than 1% of its FAARC if petroleum coke is used as fuel and less than 2% of its FAARC if coal is used as fuel. These results corroborate the results obtained using the reference dose approach in the previous analysis (Appendix D) that beryllium and mercury emissions from the proposed project would pose no threat to human health.

The nearest PSD Class I areas are more than 30 miles from the site of the proposed project; the ISCST3 air dispersion model is not recommended at such distances (EPA 1995). However, because increased concentrations of beryllium and mercury at those distances would be only small fractions of the increases near the site of the proposed project, impacts to Class I areas would be negligible.

With regard to deposition, much uncertainty exists regarding the spatial distribution of mercury deposition downwind of emissions sources. Likewise, source identification and attribution based on measurements of mercury deposition (i.e., working in the reverse direction to identify sources of measured deposition) have proven difficult. Moreover, not all emissions are produced by human activity, and lack of reliable data about the speciation of mercury in source emissions further contributes to assessment difficulties (Hanisch 1998). Controversy exists regarding the magnitude of the local impact from sources such as power plants. Global and regional models suggest that about 50% of manmade mercury emissions are transported globally, while the remaining 50% deposit on a local or regional scale (EPRI 1994; Bullock, Brehme, and Mapp 1998). Another study has indicated that mercury is more of a global or regional problem than one

of local concern because computer modeling has shown that most mercury emissions from power plants are transported over 60 miles away (Constantinou, Wu, and Seigneur 1995). However, some field measurements of oxidized, inorganic mercury appear to contradict this finding. This species normally represents only about 3% of total gaseous mercury, but is expected to account for a major portion of mercury dry deposition. On the basis of measurements near the ground in close vicinity to power plants, a study concluded that cutting a local emissions source of oxidized, inorganic mercury could result in some local reduction of deposition (Lindberg and Stratton 1998). Similar uncertainty exists for deposition of other heavy metals.

Radionuclides. Fossil fuels and limestone contain trace quantities of naturally occurring radionuclides, primarily uranium-238, thorium-232, and their decay products. During the burning of fossil fuels, inert material either falls to the bottom of the combustor as bottom ash or becomes entrained in the gaseous combustion products as fly ash. This ash contains radionuclides originally present in the fuel and/or limestone. Fly ash not captured by pollution control equipment is emitted into the atmosphere as particulate matter. In addition, two radioactive noble gases, radon-220 and radon-222, are emitted from the combustor as gases. The quantities of naturally occurring radionuclides vary according to fuel type and its geographical location; coal typically contains the greatest total quantity per unit mass.

For a proposed facility very similar to the proposed project, detailed dose pathway analyses were performed for radionuclides in coal and limestone using two different approaches: measurement of radioactive species at an operating plant (Weston 1995) and calculations based on coal analysis coupled with emission factors (DOE 1995). The estimated radionuclide emission rates for the similar facility were approximately 10 times greater than the estimated radionuclide emission rates of 6 mCi/year for the proposed project. Not including radon gas, a lifetime cancer risk to the maximum exposed person in a range of 2 in 10 million (2×10^{-7}) to 2 in 1 million (2×10^{-6}) was obtained using the two approaches. Given that emissions from the proposed project would be about 10 times lower and that typical risks would be proportionally lower, the lifetime cancer risk for the maximum exposed person would be in the range of 2 in 100 million (2×10^{-8}) to 2 in 10 million (2×10^{-7}).

Because radon is a noble gas that is not captured in particulate filters, it is often treated separately. Using an upper limit for radon of approximately 175 mCi/year (DOE 1995) and an estimated dilution at the location of maximum exposure of about 6×10^{-9} s/m^3 (the ratio of the maximum annual ground-level concentration in the ambient air calculated by the ISCST3 air dispersion model to the air emission rate), the dose is estimated to be approximately 3×10^{-4} μrem per year, which is ***about 2 billionths of the 160 mrem value given by EPA (1999b) for the dose from radon in the natural background. This small additional dose is associated with*** a lifetime risk of 1 in 100 billion (1×10^{-11}) (ICRP 1991).

Sulfuric acid mist. Air emissions of sulfuric acid mist from the proposed project were identified as an issue during public scoping. The proposed project would emit about 5 tons per year of sulfuric acid mist. By comparison, the amount specified as significant in 40 CFR Part 51.166 is 7 tons per year. Consequently, emissions of sulfuric acid mist would be less than the level of concern. Furthermore, following the related action of repowering Unit 1, there would be a net decrease of about 187 tons per year of sulfuric acid mist because the existing Unit 1 annually emits about 197 tons while each of the repowered units would annually emit about 5 tons.

Proposed project and related action. The related action of repowering the existing Unit 1 would approximately double the emissions of toxic air pollutants from Northside Generating Station that were evaluated in Tables D.1 and 4.1.5. Although emissions from the existing Unit 1, which uses natural gas and/or fuel oil, would be replaced by the related action, those existing emissions of toxic air pollutants are likely to be small in comparison with those from the repowered Unit 1, which would use coal and/or petroleum coke. Therefore, simply doubling the effects of the proposed project produces ground-level ambient concentrations that are similar, although somewhat higher, than concentrations obtained if credit were taken for (1) the elimination of emissions from the existing Unit 1, and (2) a greater initial upward momentum and buoyancy of the exhaust gas from the two repowered units operating simultaneously. Doubling the effects of the proposed project would not lead to any exceedances of, or close approaches to, any of the previously discussed guideline values for noncarcinogenic effects from toxic materials. The total cancer risk would be approximately 1.8 in 1 million per year (for the sum of the cancer risk from inhalation of dioxins, furans, and other carcinogenic substances and from ingestion of dioxins and furans), which is calculated for the location of maximum exposure. Given the upper-bound assumptions in the estimate, the risk would probably be less than this value at this location and even lower at other locations.

Visibility

Visibility, or background visual range, is defined as the maximum distance a large, black object can be observed on the horizon. The scenic quality of natural landscapes and their color, contrast, and texture, are improved by good visibility. Visibility, as a measure of clarity of the atmosphere, has been established as an important air-quality-related value of national parks and wilderness areas that are designated as PSD Class I areas.

Effects of the proposed project on visibility in the Okefenokee Wilderness Area, the nearest PSD Class I area (38 miles to the west), were analyzed using a conservative (upper-bound) screening procedure provided in Appendix B of a report prepared by the Interagency Workgroup on Air Quality Modeling (EPA 1993). Because the next nearest Class I area (Wolf Island Wilderness Area) is 63 miles north of Northside Generating Station (Section 3.2.2), any effects on visibility would be more pronounced at the Okefenokee Wilderness Area under similar meteorological conditions. The screening procedure used 24-hour concentrations obtained by applying the ISCST3 air dispersion model (in the same manner as for the criteria pollutants) to maximum hourly emissions of SO_2, NO_x, and PM-10 (Table 4.1.1). Calculations were made for existing emissions and expected emissions after the Unit 1 repowering (Table 4.1.1). The highest modeled 24-hour average concentrations for all 5 years (1984–88) were included in the analysis. A background visibility of 40 miles was used.

The results of the screening analysis indicate that the reduction in emissions of SO_2, NO_x, and PM-10 associated with the proposed project and the related action of repowering Unit 1 (Table 4.1.1) would lead to an increase in visibility of about 0.6 mile. This analysis exaggerates the effects on visibility of changes in concentrations of air pollutants; it is not likely that a change in visibility would be noticed at any Class I area as a result of the proposed project, either alone or in conjunction with the related action of repowering Unit 1. Nevertheless, the procedure does indicate that the net effect on visibility would be beneficial rather than detrimental.

Acidic Deposition

Acid rain, the popular name for acidic deposition, occurs when SO_2 and NO_x are chemically transformed and transported in the atmosphere and deposited on the earth's surface in the form of wet (rain, snow, fog) or dry (particle, gas) deposition. SO_2 and NO_x are readily oxidized in the atmosphere to form sulfates and nitrates. Subsequently, the sulfates and nitrates may form sulfuric acid and nitric acid when combined with water, unless neutralized by other chemicals present.

Acidic deposition may contribute to the acidification of lakes and subsequent damage to aquatic systems. Forests and agriculture are also potentially vulnerable because acidic deposition can cause leaching of nutrients from soils, inhibit microorganisms that convert atmospheric nitrogen into fertilizers for plants, and contribute to the release of toxic metals (EPA 1988). Acidic deposition also contributes to the corrosion of metals and deterioration of stone in buildings, statues, and other cultural resources. Sulfate particles and NO_2 also reduce visibility by interfering with light transmission in the atmosphere. Whether a ton of SO_2 or a ton of NO_x is more damaging depends on several factors, including the nature of the resource to be protected and the time scale under consideration. In general, however, there is no clear reason to consider either of these two precursors of acidic deposition as more damaging than the other on a ton-for-ton basis.

SO_2 and NO_x can be transported by the wind for hundreds of miles from one region to another. Therefore, air over any given area will contain some residual emissions from distant areas and infusions received from nearby areas. This continuing depletion and replenishment of emissions along the path of an air mass makes it extremely difficult to determine relationships between specific sources of emissions and acidic deposition at any particular location.

As a consequence of JEA management's target of a 10% reduction in annual emissions of SO_2 and NO_x from Northside Generating Station, annual SO_2 emissions would decrease from 13,649 tons to 12,284 tons and annual NO_x emissions would decrease from 4,000 tons to 3,600 tons, effective for both the transition period after the Unit 2 repowering and after the Unit 1 repowering (Table 4.1.1). Table 4.1.6 compares these changes in annual emissions of SO_2 and NO_x as a consequence of the proposed project with 1996 emissions from Florida (EPA 1997), which was chosen as an appropriate

Table 4.1.6. Changes in emissions of acid-rain precursors as a consequence of the proposed project compared to emissions from all sources in Florida

Pollutant[a]	1996 Florida emissions[b]	Changes in emissions: Tons/year[c]	Changes in emissions: As a percentage of Florida emissions
SO_2	804,000	−1,365	−0.17
NO_x	911,000	−400	−0.04

[a]SO_2 = sulfur dioxide; NO_x = oxides of nitrogen.
[b]Florida emissions were obtained from EPA (1997).
[c]From Table 4.1.1.

area to represent emissions affecting acidic deposition. Emission decreases of SO_2 and NO_x from Northside Generating Station would be only a small fraction of a percent of existing emissions from Florida. Thus, this beneficial reduction in emissions would probably not result in perceptible changes in acidic deposition.

Global Climate Change

A major worldwide environmental issue is the possibility of major changes in the global climate (e.g., global warming) as a consequence of increasing atmospheric concentrations of "greenhouse" gases (Mitchell 1989). The atmosphere allows a large percentage of incoming solar radiation to pass through to the earth's surface, where it is converted to heat energy (infrared radiation) that does not pass back through the atmosphere as easily as the solar radiation passes in. The result is that heat energy is "trapped" near the earth's surface. This phenomenon is commonly called the greenhouse effect because of an analogy with the glass in a greenhouse. However, the use of the term greenhouse effect to describe these radiative processes is somewhat of a misnomer because the main effect of the glass in a greenhouse is to act as a physical barrier that keeps the warm air inside.

Greenhouse gases include water vapor, CO_2, methane, nitrous oxide, O_3, and several chlorofluorocarbons. The greenhouse gases constitute a small percentage of the earth's atmosphere; however, their collective effect is to keep the temperature of the earth's surface about 60 °F warmer, on average, than it would be if there were no atmosphere. Water vapor, a natural component of the atmosphere, is the most abundant greenhouse gas. The second-most abundant greenhouse gas is CO_2, which has increased about 30% in concentration over the last century. It is generally agreed that fossil fuel burning is the primary contributor to increasing concentrations of CO_2 (DOE 1989). The increasing CO_2 concentrations may have contributed to a corresponding increase in globally averaged temperature in the lower atmosphere (IPCC 1992).

Because CO_2 is stable in the atmosphere and essentially uniformly mixed throughout the troposphere and stratosphere, the climatic impact does not depend on the geographic location of sources. Therefore, an increase in CO_2 emissions at a specific source is effective in altering CO_2 concentrations only to the extent that it contributes to the global total of fossil fuel burning that increases global CO_2 concentrations.

The proposed project would increase global CO_2 emissions by about 2,293,100 tons per year (Table 2.1.1), which is about 0.009% of annual global CO_2 emissions from fossil fuel combustion (Table 4.1.7). The proposed project in conjunction with the related action of repowering Unit 1 (taking credit for the elimination of emissions from the existing Unit 1) would increase global CO_2 emissions by about 3,842,800 tons per year, or about 0.015%. Increases expected from the proposed project alone or in conjunction with the related action are ***small*** in comparison with U.S. and global totals.

Table 4.1.7. Emissions of carbon dioxide (CO_2) from the proposed project by itself and in conjunction with the related action of repowering the existing Unit 1 compared to U.S. and global emissions from combustion of fossil fuels

	Emissions		
Source	(tons/year)	(As % of U.S. total of 5,643,991,000 tons/year)[a]	(As % of global total of 25,128,900,000 tons/year)[a]
Proposed project	2,293,100	0.04	0.009
Proposed project in conjunction with the related action	3,842,800	0.07	0.015

[a]National and global CO_2 emissions were taken from Marland et al. (1998) and converted to tons of CO_2 per year. Emissions from consumption of coal, oil, and gas and from gas flaring are included.

Airborne sulfates from fossil fuel combustion may be counteracting the greenhouse effect by increasing the reflection of incoming solar radiation (Mitchell et al. 1995). However, ***because*** annual SO_2 emissions during the transition period after the Unit 2 repowering and after the Unit 1 repowering would decrease by 10% (1,365 tons) (Table 4.1.1)***, there would be less airborne sulfates to counteract the greenhouse effect***. Assuming SO_2 emissions are proportional to atmospheric sulfate loadings and global anthropogenic SO_2 emissions are about 145 million tons per year (Hameed and Dignon 1992; Graedel and Crutzen 1993), then the proposed project in conjunction with the related action would decrease global anthropogenic sulfate loadings by about 0.001%. This reduction would enhance any CO_2-induced warming of the lower atmosphere, but it is not possible to provide a good estimate of the amount of the effect. In any case, the contribution of the proposed project and related action to global climate change would be ***small***.

As an additional perspective, the following evaluation compares CO_2 emissions to the amount of electricity generated at Northside Generating Station. As a consequence of the proposed project, CO_2 emissions and power production would both increase. The ratio of CO_2 emissions per MWh of electricity generated by the repowered units is estimated to be 0.98 tons per MWh (Table 2.1.1). Assuming that the ratio of CO_2 emissions per MWh of electricity generated from the existing Unit 3 is the same as the ratio for the existing Unit 1 (calculated from Table 2.1.1), the current amount of CO_2 emitted per MWh of electricity generated at Northside Generating Station is estimated to be 0.73 tons per MWh. Assuming that there would be no change in the existing capacity factors until the units are repowered and then the capacity factor for the repowered units would be 90%, it is estimated that the amount of CO_2 emitted per MWh of electricity generated would increase at Northside Generating Station to a ratio of 0.85 tons per MWh during the transition period after the Unit 2 repowering. The expected ratio would further increase after the Unit 1 repowering to 0.91 tons per MWh. The combined result of the proposed project and the related action would thus be an approximate 25% increase in the amount of CO_2 emitted per MWh generated at Northside Generating Station. This increase would be a result of using coal and petroleum coke in the repowered units whereas natural gas and fuel oil are currently used in the existing units.

4.1.3 Surface Water Resources

4.1.3.1 Construction

No change in the existing utilization or consumption of surface water would occur during the construction phase of the repowering of Units 1 and 2. All construction would be performed in accordance with an erosion and sedimentation control plan (JEA 1995; Foster Wheeler 1998b). Standard engineering practices such as straw berms, liners, cover materials, and grading would be implemented as required to minimize runoff, erosion, and sedimentation near the site. A Submerged Lands & Environmental Resource Permit (SLERP) would be obtained from the FDEP for the construction and operation of the storm water treatment system. Impacts attributable to construction-related runoff, turbidity-causing agents, erosion, and sedimentation would be minimal.

Accidental spills of construction materials such as solvents, paint, caulk, oil, and grease that could contain hazardous substances would be cleaned up in a timely manner and in accordance with a spill prevention, control, and countermeasure plan (JEA 1992) and best management practices plan. The rapid cleanup would minimize the overland flow of accidental spills into San Carlos Creek or the back channel of the St. Johns River.

4.1.3.2 Operation

Hydrology

Because Unit 2 has not operated since 1983, the proposed project (the repowering of Unit 2) would increase the demand for noncontact cooling water (however, not above permitted quantities). The current demand for cooling water by Units 1 and 3 combined is 620 Mgd (430,700 gpm) (Figure 2.1.9). After Unit 2 is repowered, the entire 3-unit plant would use 827 Mgd (574,000 gpm) (Figure 2.1.8). This would be approximately the same rate at which cooling water was used when the three units operated together from approximately 1978 until 1980. The sustained flow of the back channel of the St. Johns River would not be depleted by this diversion because 815 Mgd (566,000 gpm) of the 827 Mgd (574,000 gpm) of withdrawn cooling water would be returned to the river after passing through the condensers (Figure 2.1.8).

The tidal movement of seawater to and from the Atlantic Ocean ensures that Northside Generating Station would have a continuous supply of cooling water for the condensers even under conditions of prolonged drought. The tides would continue to occur twice daily even if the supply of fresh water flowing through the St. Johns River were reduced substantially by drought. The Atlantic Ocean serves as a virtually infinite source of cooling water for Northside Generating Station.

The rate at which heat would be rejected to the St. Johns River also would increase from the current operating level of 4×10^9 Btu/hour to 5.3×10^9 Btu/hour after Unit 2 is repowered (EVSC 1983). However, the size of the thermal plume would not increase because the simultaneous operation of all three units would increase the discharge velocity, which would promote mixing and heat dissipation (Section 3.3.4). The thermal plume would be approximately the same size as when all three units operated at full capacity from 1978 until 1980.

With Northside Generating Station at full load, the related action of repowering Unit 1 would result in little or no change compared with facility operation after the proposed project is in operation because there would be little or no change in the rate at which cooling water would be required and the rate at which heat would be rejected to the river. However, because Unit 1's capacity factor would increase from about 30% (Table 4.1.1) to about 90% after its repowering, the annual volume of cooling water withdrawn from and returned to the river and the annual quantity of heat rejected to the river from Northside Generating Station would increase by approximately 40%. The potential impacts to aquatic organisms resulting from this increased capacity factor are discussed in Section 4.1.6.2.

The permitted maximum total flow of 827 Mgd (574,000 gpm) of noncontact cooling water for the three units at full load, which is specified in NPDES permit FL0001031 (JEA 1997b), would remain the same after the repowering. The temperature and total surface area of the thermal plume would not exceed the regulatory limits defined in the NPDES permit (Section 3.3.4) (JEA 1997b). The maximum width of the 2°F thermal discharge zone after repowering would not exceed the 275-yd NPDES permit limit.

There are no dams located near Northside Generating Station whose failure would induce a dam-break flood wave to jeopardize the structural integrity of the proposed CFB combustors. Rodman Dam is a low-head structure that is located approximately 80 miles upstream. The volume of water behind Rodman Dam is insufficient to sustain a dam-break flood wave over this distance that would inundate Northside Generating Station. The lakes of the St. Johns River are naturally formed bodies of water that were not created by manmade dams and would not endanger Northside Generating Station.

Runoff from facilities that would be built as part of the proposed project would be used in plant processes or routed through detention basins equipped with baffles or oil skimmers prior to being discharged at stormwater outfalls. The detention basins would reduce the maximum rate of stormwater discharge by increasing the length of time during which the discharge occurred. The baffles or oil skimmers would collect contaminants such as oil and grease that float on top of the stormwater. Environmental impacts associated with the runoff of stormwater would be minimized by the use of detention basins equipped with baffles or oil skimmers.

The existing Northside Generating Station stormwater discharges are regulated in accordance with a general permit (FLR00B341) issued by EPA (JEA 1997b). Coverage under a modified multi-sector general stormwater permit would be sought for the repowered Northside Generating Station.

Accidental spills from the proposed facility would be cleaned up in a timely manner in accordance with a spill prevention, control, and countermeasure plan (JEA 1992) and the best management practices plan for the facility (JEA 1995). The rapid cleanup of an accidental spill would minimize runoff into San Carlos Creek or the back channel of the St. Johns River and seepage into the groundwater. Two spills have occurred at Northside Generating Station during the unloading of fuel oil shipments. Corrective action was taken to prevent or mitigate further spills.

Tanks containing liquids such as fuel oils, waste oils, turbine lubrication oils, and fuel additives are either (1) surrounded by berms or dikes that would contain accidental leaks or spills, or (2) have controlled drainage areas whose runoff is routed to and collected in sumps (JEA 1992). The sumps are piped into the chemical wastewater treatment system. The berms or dikes and controlled drainage areas would prevent runoff from flowing overland into San Carlos Creek or the back channel of the St. Johns River if a tank failure released the stored liquid. Rapid cleanup of any liquid impounded by secondary containment that did not enter the wastewater treatment system would minimize seepage into the groundwater.

Power plant transfer piping is located above ground where practical and in areas protected by secondary containment or that drain to the wastewater treatment system (JEA 1992). Much of the remaining piping is located over paved or sandy areas that eventually flow overland into floor drains or drainage ditches. Guillotine failure (i.e., sheared off in a manner similar to the action of a paper cutter) of some portions of the transfer piping or undetected excess leakage at flange gaskets, pipe joints, or valve stem seals could cause an accidental spill with no secondary containment. The piping that connects the terminal unloading facility and the fuel oil storage tanks is not provided with secondary containment. Impacts associated with transfer piping failure or leakage would be minimized because (1) the piping is routinely inspected on a daily basis and more frequently while pumping is in progress, and (2) most pipeline failures manifest themselves as small-scale, gradually increasing leaks that would be detected during routine inspection before excess leakage would impact the environment.

Water Quality

Because of hydrodynamic processes and inputs of contaminants from a variety of sources into the lower St. Johns River, any incremental effects on water quality in this section of the river resulting from operation of the combined St. Johns River Power Park/Northside Generating Station facilities would be very difficult to detect or assess. The hydrodynamics of the lower St. Johns River are dominated by tidal processes which can create highly variable currents and tidal flow regimes. With an average of four tidal flow changes each day, contaminants in the lower St. Johns tend to be diluted and eventually flushed out of the system. The hydrology regimes of the lower St. Johns River system are primarily responsible for distributing and determining the fate of natural and anthropogenic sources of nutrients and pollutants (Brody 1993). Because of the low hydraulic gradient and the dominating tidal flow in this portion of the river, the net flow of the river can often be negative over a 24-hour period. Under certain conditions (such as during low rainfall periods), the river can actually flow upstream prolonging flushing and therefore having little effect on improving water quality in the vicinity of the site. In addition, because the St. Johns River in the site vicinity is downstream from the urban core of Jacksonville, the water quality in this section of the river is probably much more reflective of upstream inputs of industrial and domestic discharges than of inputs from the St. Johns River Power Park/Northside Generating Station facilities.

In addition to the effluent discharges from the power plant facilities, water quality in the St. Johns River in the site vicinity could also be potentially affected by dredging operations. Dredging for the new fuel unloading dock (Option 2) would occur between the edge of the present channel and the present dock facility. Approximately 150,000 yd^3 of sediment would be removed to expand the channel depth from an average of −25 to −40 ft amsl. Approximately one-third (5 ft) of this dredge material would represent sediment in the upper layer that has been deposited since previous dredging operations, and the remaining two-thirds (10 ft) underneath would represent old or relatively clean sediment. These dredging activities, which are regulated under Section 404 of the Clean Water Act, would not be expected to have an adverse effect on local water quality except for brief periods during the operation itself. The only major water quality change would be localized increases in turbidity and fine suspended sediment. Dredge spoil from such operations is usually pumped to a dredge spoil holding pond on the site where slurry water in the pond slowly percolates through the sandy retention basin. Some discharges of decant from the dredge spoil holding pond into San Carlos Creek could occasionally occur, however, during periods of heavy use or rainfall. Even though this type of discharge is generally excluded from NPDES permitting, regulations pertaining to return water from upland contained disposal areas are addressed under Section 404 of the Clean Water Act. Utilization of the dredge spoil site and any discharges associated with the spoil site would be addressed in the SLERP, which would be jointly reviewed by the FDEP and the COE.

4.1.4 Geological Resources

4.1.4.1 Groundwater

Water supply during construction of the proposed project would be obtained from the existing Northside Generating Station potable water supply pumped from groundwater. Water use during construction would include rinsing of equipment and structures as well as preparation of mixtures such as grout. Because concrete would be prepared off the site, groundwater use at Northside Generating Station would not be affected by concrete formulation. Water would be available to extinguish accidental fires that could occur during construction. The finite duration and size of the project as well as the intermittent use and consumption of water during construction would not cause the existing potable water wells to be overpumped.

The pipeline that delivers treated groundwater would be tapped and used to provide water for construction activities. The existing Northside Generating Station infrastructure would be used to supply drinking water and service lavatories and toilets. Drinking water for construction workers also would be provided using bottled water. Portable toilets would be provided to minimize requirements for additional sanitary water.

During operation of the proposed project, groundwater consumption by Northside Generating Station would be reduced by 10% from the upper Floridan aquifer, based on a comparison of the existing and proposed water balances in Figures 2.1.9 and Figure 2.1.8, respectively. A 10% reduction in groundwater consumption, which is the goal set by JEA, would decrease the rate of decline of the potentiometric surface of the upper Floridan aquifer. Stabilization of the potentiometric surface would result in two primary benefits: (1) more groundwater would be available to Northside Generating Station and other local users for a longer period of time and (2) the water quality would be stabilized because of the reduced influx of brackish water from the lower Floridan aquifer.

The impact to the surficial aquifer during operation of the proposed project would be considerably less than under existing conditions. The currently unlined settling ponds would be lined for the proposed project, and the supernatant from the settling ponds would be routed to the reuse tank. The overflow from the settling ponds would be directed to the existing percolation pond, and consequently to the surficial aquifer, only on an occasional basis when the reuse tank is full. Following operation of the proposed project, the groundwater mound beneath the percolation pond would be reduced considerably in size and the impact on surrounding groundwater, wetlands, and streams would correspondingly be reduced. Although the proposed project's filter backwash water would be relatively rich in suspended solids that are removed from the main effluent by the filtration unit, its chemical character would be similar to the existing effluent in the percolation pond. Alkaline leachate from the uncovered limestone storage pile would percolate from the surface to the surficial aquifer, which would tend to neutralize the surficial aquifer's acidic nature [as indicated by routine analyses of samples from the background well (NS19)].

Contaminants would be unlikely to migrate downward from the surficial aquifer to the upper Floridan aquifer. As discussed in Section 3.4, the two aquifers are hydraulically isolated from one another and the upper Floridan aquifer has a higher potentiometric surface. Natural hydraulic isolation is provided by the confining strata in the Hawthorn Formation, and the production wells in the upper Floridan aquifer are cased-off from the surficial aquifer. The casing consists of steel tubing that has perforated walls only in the production zone and is completely surrounded by cement extending from the surface down to immediately above the production zone. Routine servicing of production wells helps maintain the integrity of the well casing and annular grout, thus reducing the chance for a breach between the surficial and upper Floridan aquifers.

The hydraulic pressure differential between the two aquifers would cause upward flow from the Floridan aquifer to the surficial aquifer in the event that hydraulic connection would be established between them. At present production rates in the upper Floridan aquifer at Northside Generating Station and the St. Johns River Power Park, the upper Floridan aquifer's potentiometric surface would be likely to remain higher than the surficial aquifer's potentiometric surface during the lifetime of the proposed project (Section 3.4).

4.1.4.2 Subsidence

Because the characteristics of the two small topographic depressions located on the south side of and immediately south of the dredge spoil site are not fully known (Section 3.4.6.1), subsidence from limestone solution cavities at a shallow depth on the site cannot be completely dismissed. However, such cavities are rare in the Jacksonville area because shallow limestone lenses are thin and discontinuous (Section 3.4.6.1). Sudden collapse or gradual subsidence at the surface does not generally occur unless the depth to the cavity is less than 6 or 30 times, respectively, the thickness of the cavity. For example, a 2-ft-thick cavity would need to be within 12 ft of the surface to cause collapse or within 60 ft of the surface to cause measurable subsidence. Large and extensive solution cavities in the Floridan aquifer would not be a concern because they are more than 800 ft deep in the Jacksonville area.

One topographic depression is located at the proposed site for the covered fuel storage enclosure and the other topographic depression is located at the proposed site for the limestone storage pile (Figure 3.4.2) under Option 2 for the solid fuel and limestone delivery and handling system (Section 2.1.3). Because the overall weight of the covered fuel storage enclosure and its fuel would be less than the overall weight of dredge spoil previously stored at the first location, subsidence or structural collapse of a potential solution cavity as a result of the new storage enclosure would be unlikely. At the second location (south of the dredge spoil site), subsidence or collapse of the limestone storage pile into a thin cavity would not be a major concern because of the nonhazardous characteristics of limestone and the absence of structures associated with the pile.

Geotechnical site investigations would precede construction of any new major structures associated with the proposed project. Such investigations would be designed to reveal any solution cavities within 100 ft of the surface that might cause the surface to collapse or subside appreciably. If a cavity were detected, collapse and subsidence at the surface would be prevented by filling the cavity.

4.1.4.3 Settlement and Erosion

Settlement and erosion potential were discussed in Section 3.4.6.2. Geotechnical site investigations would reveal any unusual settlement and erosion features prior to construction of major structures associated with the proposed project. Standard foundation preparation such as densification of unconsolidated sands and removal of soils mixed with decaying vegetation would be accomplished prior to construction of structures. Proper foundation preparation would prevent structural damage and reduce cosmetic damage during the lifetime of the proposed project. Site preparation and construction would also be preceded by development and implementation of an erosion and sedimentation control plan (ESCP) and a spill prevention, control, and countermeasures plan (SPCCP). Critical facilities would be protected from foundation erosion by protective layers of riprap, vegetation, or storm-surge energy deflectors, as appropriate.

4.1.4.4 Earthquakes

Section 3.4.6.3 discussed probabilities and consequences of earthquakes in northern Florida. Site-specific earthquake analyses have not been performed because such analyses are reserved for high-hazard facilities (e.g., nuclear power plants).

Earthquake design at the proposed site would be based on recommendations contained in the Uniform Building Code (UBC) (Section 3.4.6.3). UBC seismic design features are based on the regional seismic hazard analyses of Algermissen et al. (1990). Staub (1991) demonstrated that Algermissen's seismic hazard analyses are generally conservative with respect to site-specific analyses at U.S. nuclear power plants located east of the Rocky Mountains. The design ground motion of 0.075 g has a 10% probability of exceedance in 50 years. Because the proposed facilities have a design life of 30 years, the probability of exceedance would be less than 10%. If a larger earthquake should occur, damage would range from slight to significant depending on the size of the earthquake. Onsite impacts would be similar to existing potential impacts from earthquakes except that the proposed higher stacks would be more likely to experience damage, and slope failures could occur along the steep sides of the 100-ft high ash storage pile. Impacts to offsite areas would include possible loss of electric power and damage to existing infrastructure until repairs could be completed.

The local faults postulated by Leve (1978) do not contribute to the earthquake hazard. If these faults exist, they do not reach the surface and do not displace Miocene and younger strata (strata that are less than 22 million years old).

4.1.5 Floodplains, Storm Surge, and Wetlands

The DOE regulation (10 CFR Part 1022) implementing Executive Order 11988 (Floodplain Management) and Executive Order 11990 (Protection of Wetlands) requires DOE to avoid direct and indirect support of development in floodplains and wetlands wherever there is a practical alternative. Where there is no practical alternative, DOE is required to prepare a floodplain and wetlands assessment discussing the effects on the floodplain and wetlands, and consideration of alternatives. DOE is also required to provide opportunity for public review of any plans or proposals for actions in floodplains (and new construction in wetlands). The floodplain and wetlands assessment discussing the effects on floodplain and wetlands anticipated from this proposed project has been prepared and included in this EIS, as required by DOE regulation [10 CFR Part 1022.12(b)]. For a full review of the floodplain and wetlands assessment, please refer to these parts of the EIS: Section 3.5.1 (Floodplains—Existing Environment), Section 3.5.3 (Wetlands—Existing Environment), Section 4.1.5.1 (Floodplains—Environmental Consequences), Section 4.1.5.3 (Wetlands— Environmental Consequences), and Section 7 (Regulatory Compliance and Permit Requirements). Opportunity for public comment and suggestions on the proposed scope of the EIS, including floodplain and wetlands issues and alternatives, was provided during the public scoping period announced by the Notice of Intent published by DOE on November 13, 1997 (62 *FR* 60889–92). Additional opportunity for public review of the proposed project's potential effects on floodplain and wetlands ***was*** provided during the public comment period on ***the*** draft EIS.

For actions that would be located in a floodplain, DOE regulations require a brief statement of findings describing the proposed action, location, alternatives considered, compliance of the proposed project with applicable state and local floodplain protection standards, and steps to be taken to minimize potential harm to or within the floodplain. The statement of findings for this proposed action has been incorporated into the EIS (Section 7.1), as provided by DOE regulation [10 CFR Part 1022.15(b)(5)].

The estuarine emergent wetlands in the project area have been identified by the National Marine Fisheries Service as Essential Fish Habitat (Letter No. 7 in Appendix G). DOE has consulted with the National Marine Fisheries Service on measures to protect Essential Fish Habitat. As part of the consultation, DOE prepared an Essential Fish Habitat Assessment dated January 24, 2000 (Appendix F), in which DOE determined that there would be no substantial

adverse effect on Essential Fish Habitat in the project area as a consequence of the proposed project. After reviewing the Essential Fish Habitat Assessment, the National Marine Fisheries Service requested additional clarifying information regarding the wetlands in a letter dated February 23, 2000 (Appendix F). After receiving the additional information from DOE, the National Marine Fisheries Service sent a letter to DOE dated March 27, 2000 (Appendix F), in which they stated that they concur with DOE's determination that the project would not adversely affect Essential Fish Habitat and that they have no further objection to the project.

4.1.5.1 Floodplains

The main structure that houses the turbines for Units 1, 2, and 3 at Northside Generating Station resides on a graded, nearly level site with an approximate land elevation that—for the most part—slightly exceeds 10 ft amsl (USGS 1992b). Flooding of the main structure would not be anticipated because the September 10, 1964, flood of record that occurred during hurricane Dora rose to an elevation of only 7.9 ft amsl at this location (Section 3.5.2).

Most of the land for the existing and proposed power blocks is located above the 500-year floodplain of 10 ft amsl (Section 3.5.1). A small portion of this land along the southern edge of the existing and proposed structures could be inundated by an approximate 100- to 500-year flood to depths averaging less than 1 ft. Nuisance flooding of this type would not endanger the repowered units or the remaining Unit 3 because the boilers and major combustion equipment are located either on or above the second floor.

The covered fuel storage enclosure under Option 2 for the solid fuel and limestone delivery and handling system (Section 2.1.3) would be located along the southern edge of the dredge spoil site (Figure 3.4.2), lying above the 500-year floodplain. Contamination attributable to fuel pile runoff would not be anticipated because the enclosure would provide isolation from rainfall during an extreme precipitation event.

The surge buildings (that would be used to store petroleum coke and coal and to facilitate a steady supply to the conveyor) and the temporary limestone pile at the receiving facilities would be located on the 100-year floodplain along the St. Johns River. These facilities would be subjected to flooding during such an event. The surge buildings would partially protect and retain the petroleum coke and coal. The large quantities of water that would be present during an extreme flood would rapidly dilute any flood-induced seepage of dissolved petroleum coke or coal from the surge facilities to very low concentrations. Inundation and concomitant failure of the limestone pile would not be of concern. Limestone (Whitten and Brooks 1972) consists of the minerals calcite ($CaCO_3$) and dolomite [$CaMg(CO_3)_2$]. Both calcium (as Ca^{2+}) and magnesium (as Mg^{2+}) already are major contributors (i.e., the calcium and magnesium are pervasive) to the salinity of seawater (Duxbury 1971).

The fuel unloading facilities that are part of the proposed project would not encroach measurably on the floodplain. The surge buildings for petroleum coke and coal, the limestone pile, and pilings associated with the conveyor would not be large enough to block the natural flow of the river and tides. The vast array of tidal marshlands, the relatively low topographic relief in the vicinity of Northside Generating Station, and the sparseness of prominent features ensure that excess water present during an extreme flood would have sufficient area in which to spread out.

Construction and operation of the proposed project would not result in any stream diversions that would be large enough to alter existing offsite drainage patterns. The surface water supplied to Northside Generating Station is approximately 10% of the average flow passing through the back channel of the St. Johns River (JEA 1976). Most of this noncontact cooling water would be returned to the river such that the average flow of the river would not be impacted. The land occupied by and immediately surrounding the repowered units would be sloped to promote drainage away from structures.

4.1.5.2 Storm Surge

With regard to storm surge, the occurrence of a hurricane similar to Dora would not flood the existing and proposed power block areas at Northside Generating Station (Section 3.5.2), and the repowered units would remain standing after the hurricane had passed. Wind speeds produced by Dora place the effects of this hurricane in category 3 at St. Augustine and category 1 at Jacksonville (Table 4.1.8). The major damage from Dora slightly inland at Jacksonville was caused by wind and not by storm surge. Although some wind damage (such as broken windows and torn roofing) probably would result from a hurricane similar to Dora, major structural damage would not be expected. Power lines that have not been designed to withstand hurricane-force winds would be destroyed. The fuel unloading facilities on the 100-year floodplain would be more susceptible to hurricane-induced wave damage and would be a concern.

The predicted maximum storm surge heights in the vicinity of Northside Generating Station using the Sea, Lake, and Overland Surges from Hurricanes (SLOSH) model (NOAA 1992) are 21.7 ft for a category 5 hurricane, 18.3 ft for a category 4 hurricane, and 14.4 ft for a category 3 hurricane. These predictions are slightly greater than the general guideline used to estimate storm surge based on hurricane category (Table 4.1.8). Because the site elevation at the base of the proposed power block is approximately 10 ft amsl, the level of inundation based on the SLOSH model would be 11.7 ft for a category 5 hurricane, 8.3 ft for a category 4 hurricane, and 4.4 ft for a category 3 hurricane.

A direct hit at Jacksonville of a category 3, 4, or 5 hurricane could jeopardize the structural integrity of the repowered units. Although the inland location of Northside Generating Station, the presence of the beach ridge along the dune line, and Blount Island would partially mitigate the effects of storm surge and waves that would occur along the beaches, the first floor of Northside

Table 4.1.8. Categories of hurricane intensity

Category	Description	Wind speed (mph)	Storm surge (ft)[a]	Damage
1	Minimal	74-95	4-5	Damage primarily to shrubbery, tree foliage, and unanchored mobile homes. Minor pier damage, some small craft in exposed anchorages torn from moorings.
2	Moderate	96-110	6-8	Some trees blown over. Major damage to exposed mobile homes. Some damage to roofing materials of buildings. Small craft in unprotected anchorages torn from moorings. Evacuation of some shoreline residences and low-lying islands required.
3	Extensive	111-130	9-12	Foliage torn from trees, large trees blown over. Some damage to roofing materials of buildings; some window and door damage. Some structural damage to small buildings. Mobile homes destroyed. Serious flooding at the coast. Low-lying inland escape routes cut off by rising water 3 to 5 hours before hurricane center arrives. Flooding of flat terrain having an elevation less than or equal to 5 ft amsl[b] as far as 8 miles inland or more.
4	Extreme	131-155	13-18	Extensive damage to roofing materials, windows, and doors. Complete failure of roofs on many small residences. Flooding of flat terrain having an elevation ≤ 10 ft amsl as far as 6 miles inland. Major damage to lower floors of near shore structures from flooding and battering of waves and floating debris. Major erosion of beaches. Massive evacuation possibly required of residences within 500 yd of shore and of single-story residences on low ground within 2 miles of shore.
5	Catastrophic	>155	>18	Complete roof failure of many residences and industrial buildings. Severe and extensive damage to windows and doors. Some complete building failures. Major damage to lower floors of all structures less than 15 ft amsl within 500 yd of the shore. Massive evacuation possibly required of residential areas on low ground within 5 to 10 miles of the shore.

[a]General guideline to estimate the depth of water above the normally occurring water level.
[b]Above mean sea level (amsl).
Source: ***Lutgens and Tarbuck 1998.***

Generating Station could be inundated. Wave-induced forces could destabilize the base of the structures while hurricane-force winds could simultaneously damage the structures. In a worst-case scenario, the repowered units could be toppled. The storm surge also could destroy the fuel unloading facilities. The propensity for hurricanes to bypass Jacksonville categorizes the occurrence of a category 3, 4, or 5 hurricane at Jacksonville as a low-probability, high-consequence event.

4.1.5.3 Wetlands

Ecological impacts to wetland areas from the proposed project would be minor because no more than 1.8 acres of isolated hardwood wetland habitat would be lost during construction of the ash storage area and disturbance of salt marsh habitats during construction of the solid fuel delivery system would be negligible. Wetlands associated with the upper salt marsh communities would not be measurably affected because nearly all of the conveyor system for solid fuel delivery associated with either unloading option would span these habitats using existing structures and would involve no clearing or earthmoving activities. Although some pilings may need to be installed at the upper fringes of the salt marsh and in San Carlos Creek, any impacts resulting from piling installation would be very localized and temporary and should not measurably affect the normal structural and functional dynamics of the salt marsh and nearby estuarine ecosystems.

Delineation of wetland boundaries near the site was particularly difficult during the winter of 1997–98 because of high rainfall and resulting high water levels. Consequently, the exact amount of wetland area to be disturbed by the ash storage area was difficult to determine. However, loss of only about 1 acre of hardwood wetlands south of Ostner Road and 0.8 acre north of Ostner Road would not measurably affect the ecological status of the wetland communities in the site vicinity because (1) 1.8 acres of hardwood wetlands represents no more than 2% of this type of ecological habitat that occurs within a 1-mile radius of the site and these wetland systems are prevalent throughout northern Florida and (2) some of the hardwood wetland communities in the site vicinity have experienced some deterioration over the past few years (even though they are still given the same consideration as undisturbed wetlands for ecological potential). Specifically, an old dirt road, which traverses through portions of the wooded area northeast of the site, functions as an impediment to natural hydraulic flow through a part of the wetland areas because the road is elevated a few feet above the ground and has no breaks or passages for water to flow from one side to the other. The wetland systems on opposite sides of the road are different: those on the downstream side of the road, including the 1 acre south of Ostner Road to be used for the ash storage area, have experienced some deterioration in their ecological character, perhaps because of altered hydraulic flow regimes in this area. Construction activities should not affect this situation because the primary restriction to water flow in this section of the wetlands system appears to be the existing dirt road.

Originally, another site was considered for the ash storage area, which included a 1-acre wetland site within the San Carlos Creek floodplain. However, after an alternative analysis was conducted under DOE regulations 10 CFR Part 1022, the current site was chosen because it minimizes potential impacts. The current site includes a 200-ft buffer zone extending to the San Carlos Creek floodplain, which would minimize any impacts to the San Carlos Creek system.

As a mitigation measure to offset the loss of 1.8 acres of hardwood wetlands during construction of the ash storage area, JEA would purchase 3 credits (slightly greater than 3 acres) of wetlands from an offsite mitigation bank and restore 1 acre of salt marsh, resulting in a mitigation ratio of greater than 2.2 to 1 (more than 4 acres of wetlands gained to 1.8 acres lost). The 1.8 acres of hardwood wetlands are not high-quality habitats, as evaluated by the COE wetlands rapid assessment procedure. Both the COE and the FDEP approve of this mitigation plan. In addition, JEA plans to set aside and preserve 15 acres of undisturbed, uplands maritime oak hammock along the west bank of San Carlos Creek. By preserving the land, JEA would maintain habitat for wildlife, help protect the water quality of the creek, and leave a high-quality forested buffer area in a developing industrial area. Access to the preserve would be limited to a primitive walking path. Preservation of this land is considered a project enhancement rather than a mitigation measure.

4.1.6 Ecological Resources

4.1.6.1 Terrestrial Ecology

The ash storage area would require harvesting of approximately 28 acres of pine plantation and loss of 10 acres of upland hardwood/pine habitat. These areas are located immediately north of the 40-acre dredge spoil area. Disturbance or removal of this pine and hardwood acreage would not have a measurable effect on the ecological status of these terrestrial systems because of the prevalence of these communities in the vicinity of the site. Pine flatwood communities, in particular, are not only common in the area, but also make up a large percentage of terrestrial systems in northern Florida. Also, wildlife that frequent these habitats would not be measurably affected because sufficient similar habitat borders the disturbed area and wildlife species could easily relocate and/or recolonize these adjacent sites.

Gopher tortoises, a state protected species, frequent the pine flatwood areas, including the pine plantation, because of the availability of well-drained sandy soils for construction of their burrows. Loss of 28 acres of pine flatwood habitat would not measurably affect the distribution and success of the gopher tortoise populations because of the widespread availability of similar habitats in the site vicinity and the ability of this species to rapidly recolonize previously disturbed areas. Relocation of tortoises provides them a better chance of survival than taking no action. However, some mortality is still possible. Previous tortoise relocation efforts by JEA have apparently been successful and researchers at Jacksonville University have also successfully relocated tortoises on the university grounds. Any tortoises that are relocated on the Northside property because of construction activities would be moved only a few hundred yards and re-established in similar habitats of raised sandy berm areas. JEA personnel have noted that tortoises are relatively mobile and dig and abandon burrows frequently. In fact, recent excavation efforts found only one tortoise in six burrows excavated. JEA's permit from the Florida Game and Freshwater Fish Commission limits the number of tortoises to be relocated, specifies how they are to be captured, and indicates where they are to be relocated.

4.1.6.2 Aquatic Ecology

Potential impacts of the proposed project on the aquatic ecology in the site vicinity primarily are associated with the thermal discharge system, entrainment and impingement of organisms into the cooling water intake system, use of biocides, and dredging of the St. Johns River to expand the dock facilities for fuel unloading (Option 2). Because thermal, entrainment, impingement, and dredging related impacts directly involve the back channel of the St. Johns River, the following analysis focuses on the aquatic ecology in this section of the river.

Thermal Effects

The design criteria for the proposed project would maintain the circulating flow rates and condenser temperature rises that are currently authorized under NPDES Permit FL001031 (i.e., maximum withdrawal rate of 827 Mgd, maximum temperature rise of 19 °F, and maximum daily average of 104 °F). Additionally, the total area of the discharge plume would be regulated by limits currently specified in the NPDES permit renewal (Section 3.3.4). The thermal discharge limits were formulated using results from thermal plume mathematical modeling studies that assessed and substantiated the preoperational design of Northside Generating Station (JEA 1976), as well as results of an extensive biomonitoring program which was conducted over a 2-year period during the time when all 3 units were in operation (EVSC 1981b). Thermal plume mapping surveys demonstrated, however, that the extent of the Northside Generating Station thermal plume as defined by the area of the 2 °F mixing zone was approximately one-tenth the size of the plume permitted by the NPDES limits (Section 3.3.4). The largest plume measured was 7 acres while the NPDES permit limit is 102 acres. Water temperature measurements recorded near the mouth of San Carlos Creek during this study also verified that the thermal plume did not penetrate into this system. During operation of the proposed project, the thermal discharge and the associated thermal plume from Northside Generating Station would be maintained within the constraints established in the NPDES permit, and conditions would be very similar to those experienced for the three-unit facility during the surveys.

Several factors suggest that thermal discharges associated with the proposed project would not have measurable effects on the biota of the St. Johns River and the surrounding tidal creek/salt marsh ecosystems. Because only about 35% of the flow of the St. Johns River passes through the back channel and only a portion of the back channel is thermally elevated, the thermal plume should not act as a barrier for normal or unrestricted passage of organisms up and down the river. In addition, there is no evidence that adult or juvenile fish or shellfish congregate in the zone of thermal influence during the winter. Any increase in number of free-swimming species in the site vicinity could be attributed more to manmade structures, such as pilings and rip-rap which attract organisms, than to other environmental factors in the site vicinity (EVSC 1981b).

Most species of fish would be unlikely to reside or congregate in the thermal discharge area for extended periods of time because of the relatively swift flows (1–3 ft/s) in the channel. Under these relatively high flow conditions, some species of fish would have difficulty maintaining position in the mid-channel area for extended periods of time. In addition, this section of the St. Johns River in the vicinity of the Northside Generating Station intake and discharge is not considered a spawning area for any ecologically important fish or shellfish species (JEA 1976). Unavailability of preferred spawning or feeding habitat would also tend to minimize the probability that fish species would frequent and reside in this area for extended periods of time. It is also unlikely that bottom-dwelling organisms such as macroinvertebrates would experience effects as a result of thermal discharges because the discharge plume is directed upward and is largely a surface phenomenon.

If, however, organisms such as fish would congregate in the thermal discharge area during the winter, it is very unlikely that a cold shock event would occur because all of Northside Generating Station's units would probably never be shut down simultaneously. The repowered Units 1 and 2 would operate at a capacity factor of about 90%. In contrast, the existing Unit 1 operates at a capacity factor of about 40% (primarily during the summer and winter months to meet the larger demand for electricity resulting from the use of air conditioning and heating, respectively). Unit 3 is expected to continue its current mode of operating at a capacity factor of about 40%. A more detailed analysis of the 40% capacity factors for the existing Units 1 and 3 indicates that they are operating at full or partial load about 70% of the time and they are not operating about 30% of the time. With regard to thermal discharge, the net result of this change in operations after the repowering of Units 1 and 2 would be an environment that would minimize the potential for thermal-related impacts on aquatic organisms because the thermal discharge would be relatively constant compared with the variability of current facility operations. Therefore, maintenance of this relatively constant thermal plume would reduce the potential for cold shock and thermal-related stress to aquatic organisms in the site vicinity.

In summary, thermal discharges from the proposed project would not be expected to have a measurable effect on the biota of the area because (1) the design flow rates and temperature rises would be maintained at or below the approved limits in the 316 demonstration (Section 3.3.4) and the NPDES permit for minimizing ecological impacts, (2) organisms would not be expected to reside or congregate in the thermal plume area because of factors that limit their occurrence, (3) the extent of the thermal plume would be relatively small and should not prevent organisms from avoiding the plume area or moving freely up and down the river, and (4) the design of the discharge is such that bottom-dwelling organisms would experience minimal thermal exposure.

Entrainment and Impingement

The volume of cooling water withdrawn and water velocity at the intake screens for the proposed project would be identical to those originally evaluated in the Northside Generating Station 316 demonstration (Section 3.3.4) and would be limited as specified in the NPDES permit. The maximum water withdrawal for Northside Generating Station would be 574,000 gpm and the design velocity at the cooling water intake structures in the St. Johns River would be approximately 3 ft/s, which were found acceptable in the 316 studies for minimizing impacts to free-swimming species (JEA 1976).

On an annual basis, losses to the zooplankton population resulting from entrainment during cooling water withdrawal are predicted to be only 0.8% of the population that passes through the back channel of the St. Johns River (EVSC 1981a). Because approximately 35% of the total tidal flow of the river passes through the back channel, only about 0.3% of the total zooplankton population of the river near the vicinity of the site would be lost assuming a through-plant mortality of 100%. These relatively small losses, coupled with inherently high reproduction, recruitment, and turnover rates of small organisms such as zooplankton (Kremer and Nixon 1978), should not result in a measurable impact on the zooplankton population in the St. Johns River.

Entrainment of ichthyoplankton (finfish larvae) would impact a relatively larger percentage of its respective population than would entrainment of zooplankton in this section of the St. Johns River. Depending on the seasonal variation in the volume of water flowing in the St. Johns River, 1.0–6.5% of the ichthyoplankton population in the back channel would be subjected to entrainment. On an annual basis, an average of 2.3% of the population in the back channel would be affected. This fraction actually represents less than 1% of the total ichthyoplankton population in the river in the vicinity of the site because only about 35% of the total flow of the river passes through the back channel. About 60% of the entrained ichthyoplankton would consist of species with no appreciable commercial or recreational importance, such as croaker, spot, and silver perch, while about 40% would represent species of commercial and/or recreational value such as seatrout, weakfish, and menhaden. The effect of entrainment on the ichthyoplankton population in the St. Johns River in the vicinity of Northside Generating Station would be minor because the level of change or variability in the abundance of the population is indistinguishable from the natural variability that most fish populations experience year to year. Because most of the species represented at the site spawn offshore and in higher salinity areas, such as near the mouths of rivers, any small localized perturbations in their abundance and density resulting from entrainment would be overshadowed or masked by the natural offshore processes that influence ichthyoplankton dynamics and abundance.

Relative to impingement issues, free-swimming species should possess the swimming ability to escape the intake velocity of 3 ft/s. Current speeds in the back channel typically range from 1 to 3 ft/s, with a maximum recorded speed of 4 ft/s. Most fish species which either pass through or frequent the back channel have regularly experienced and adapted to the current speeds that occur at the water intake structure (Blaxter and Dickson 1959). In addition, most fish species can swim in short-term bursts much higher than 3 ft/s, which would usually allow them to escape impingement at the intake structure.

Impingement potential would also be minimized because the back channel in the vicinity of the site does not appear to be a preferred spawning or feeding area where important sport and commercial fish and shellfish species might congregate. The back channel is probably not a preferred feeding area because of the relatively swift currents, the relatively low density of prey such as bottom-dwelling macroinvertebrates (Section 3.6.2), and the general lack of preferred physical structures which tend to attract fish for food and shelter. The nearby tidal creeks and salt-marsh systems, however, are the preferred nursery and feeding sites for many fish and invertebrate species in the area. The general unavailability of preferred spawning and/or feeding habitat in the immediate vicinity of the intake structure would tend to minimize the probability that these species would reside in this area for extended periods of time, which would therefore decrease their long-term vulnerability to impingement.

To mitigate impingement, however, a fish return system has been in operation at Northside Generating Station since the late 1970s. This system, which was evaluated in accordance with the 316 provision and approved by the EPA as representing best available technology, consists of vertically rotating screens designed with cups and trays, low pressure sprays, and sluice water to convey free-swimming organisms unharmed to San Carlos Creek via two return troughs. In addition to the EPA evaluation and approval, associated state reviews and related permits have indicated that the facility complies with the cooling water criteria in Chapter 62-302.520 of the Florida Administrative Code. In 1981, a 1-year impingement study at Northside Generating Station found 78 species of fish impinged on the rotating screens (EVSC 1981b). Seven species (croaker, anchovy, weakfish, spotted seatrout, star drum, threadfin herring, and tonguefish) accounted for 85% of all fish impinged. Of these 7 species, croaker comprised 43.5%, or 37% of all fish impinged. In addition, 22 species of invertebrates were found impinged during this study, with the blue crab and 3 species of shrimp being the most common and important species. Except for shrimp, which were found to have a 90–100% survival rate following impingement, estimates of survival for species of organisms impinged on the traveling screens could not be assessed reliably during the study because of the low statistical sample size (EVSC 1981b).

In March 1998, JEA initiated a study to determine how to optimize the operation and maintenance of the fish return system while maintaining the system's return efficiency and the survival rate of impinged organisms. As part of the study, quarterly reports summarized the findings regarding the immediate and long-term survivability of impinged fish and invertebrate species (Golder Associates 1998a,b). Results from the spring and summer quarters of 1998 indicated that the immediate survival rate of impinged organisms as a whole varied between 72 and 93%. The long-term survival rate for seatrout was in the range of 40–100%, while the range for shrimp, a relatively tolerant species, was 80–100%. Thus, data collected to date indicate that the post-impingement survival of organisms varies as a function of the species involved and the length of time following impingement. In general, however, the long-term survival rate of most species would be at least 50%.

In summary, loss of fish and shellfish resulting from entrainment and impingement during operation of the cooling water intake system would not be expected to have a detectable impact on the populations of biota in the site vicinity because (1) entrainment losses of zooplankton and ichthyoplankton would be less than 1% of their respective populations in the St. Johns River, which is well within the normal year-to-year natural variability experienced by these populations; (2) the cooling water intake system, including the fish return system, represents the best available technology for minimizing impacts as concluded by the EPA in 1994; and (3) many species of fish and shellfish would not be attracted or reside in this area of the back channel for extended periods of time because of a general lack of preferred spawning and feeding habitats.

Dredging Activities

Construction of a new solid fuel unloading dock (Option 2) would require dredging between the navigation channel and the present dock lane in the back channel. This activity would increase the depth of the present channel an average of 15 ft by removing an estimated 150,000 yd^3 of sediment, which represents a surface area of approximately 30,000 yd^2. The elevation of the bottom of the channel currently varies between −30 and −20 ft amsl, with an average of −25 ft amsl. Because the new channel would be dredged to an elevation of −40 ft amsl, about 5 ft of the dredged material would consist of newer and potentially contaminated sediment because the channel bottom has previously been dredged to −30 ft amsl. Approximately 10 ft of the dredged material, however, would consist of old or potentially clean and uncontaminated sediment.

The two principal impacts that would occur from dredging activities are direct effects involving removal or disturbance of bottom-dwelling macroinvertebrates and indirect effects involving suspension of fine material such as silt and release of contaminants from disturbed sediment. Macroinvertebrate surveys conducted in the back channel revealed that their abundance and diversity are relatively low, consisting mainly of molluscs and in particular one species, the bivalve mollusc *Mulina lateralis*. Very few polychaetes and amphipods, which are more common in the tidal creeks, are present in the back channel area. During the spring and summer when the highest densities of macroinvertebrates occur in the back channel, *Mulina* comprises about 95% of the total population. Direct impacts on the macroinvertebrate population from dredging activities would be minor because (1) *Mulina* is abundant in this section of the river; (2) losses of organisms as a result of direct removal or replacement would be temporary because estuarine invertebrates could recolonize disturbed areas within a few months following dredging (Hanks 1968); and (3) temporary reductions in *Mulina* abundance should not affect the food availability of most finfish in the area because this organism is not an important food source for most finfish except possibly for drum. A temporary reduction in *Mulina*, however, should not affect the feeding ability of bottom foragers such as drum because this bivalve is very common in the St. Johns River.

A possible indirect effect of extended dredging operations would be an increase in suspended material, such as silt, and mobilization of contaminants from the disturbed sediments into the river water. Permanently attached organisms are usually the most vulnerable to silt and fine particles released from dredging because the filter feeding capacity of these organisms could be impaired. Indirect effects of dredging operations should be slight because (1) any increases in suspended material and turbidity would be localized and temporary; (2) very few of the more vulnerable permanently attached organisms occur in the vicinity of the site; and (3) the "zone" of turbidity or suspended material created by dredging operations would probably be small, which should allow free-swimming organisms to avoid these areas easily in their movements up and down the river. Previous maintenance dredging operations at the site have used hydraulic dredges or FDEP-approved clamshell buckets that cause minimal turbidity plumes. Turbidity from previous maintenance dredging activities has never exceeded the permitted level of 26 NTU (nephelometric turbidity units), and turbidity plumes have not been observed during these operations.

With respect to potential effects of contaminants mobilized from dredged sediments, studies conducted on oysters held for several months in cages near the Northside dock area showed that no appreciable uptake and bioaccumulation of metals occurred (Section ***3.3.2.1***). In addition, contaminant analysis of Florida coastal sediments by Seal, Calder, and Sloane (1994) demonstrated that heavy metal concentrations in the sediments of the back channel near the mouth of San Carlos Creek were at or near background levels. Even though organic contaminants, particularly polycyclic aromatic hydrocarbons, were elevated relative to background in the sediments near the mouth of San Carlos Creek, they were of equal or lower concentrations than those found at other sites in the St. Johns River near Jacksonville. Therefore, the concentration levels of pollutants mobilized from sediments during dredging operations for expansion of the Northside Generating Station dock (Section 4.1.3.2) would not be great enough to cause concern relative to their biotoxicity on resident biota.

Use of Biocides

Prior to circulating through the condensers, cooling water for the proposed project would be treated intermittently with sodium hypochlorite (NaOCl) or sodium bromide (NaBr) to control biological growth on heat exchanger tubes (Section 2.1.7.2). Sodium bromide is not expected to be used extensively because it is more expensive than sodium hypochlorite. The concentration of total residual chlorine (TRC) is limited in the NPDES permit to a maximum of 0.1 ppm in the discharge canal. TRC levels of 0.1 ppm and below have been demonstrated in laboratory toxicity testing to be safe levels for protecting aquatic organisms. Continuous TRC monitoring from the Northside discharge canal has indicated that TRC levels routinely occur at nondetectable (below 0.001 ppm) levels. During Northside operations, the period of chlorination would be limited to 2 hours per day per unit, and no two units would be chlorinated at the same time. When one unit is being chlorinated, discharge from the other units would be available for dilution. The Northside chlorination procedure would be coordinated with chlorination practices at the St. Johns River Power Park to minimize the total amount of TRC in the discharge. Because of the low levels of TRC being discharged and the dilution effects resulting from the sequenced chlorination schedules, no harm to aquatic organisms in the area of the discharge canal is expected from these chlorination practices. Because of the dilution provided by the St. Johns River, there would be no harm to aquatic organisms elsewhere in the river.

4.1.6.3 Threatened and Endangered Species

Of the protected wildlife species that have been observed in the site vicinity (Section 3.6.3), the manatee is of most concern to environmental managers and regulators. Impacts on this species from construction of the new solid fuel and limestone unloading dock (Option 2) would be minimal because manatees probably would not regularly frequent the dock area due to the paucity of submerged vegetation such as seagrasses and emergent cordgrasses (Spartina sp.) in the immediate vicinity of the dock. Manatees were observed in the late 1980s near the southern shore of Blount Island, perhaps attracted there by emergent cordgrasses (Baugh, Valade, and Zoodsma 1989). However, this area currently has a scarcity of emergent cordgrasses and is rarely visited by manatees (observation by Dr. Pinto, Jacksonville University manatee research team). Since 1993, when the city of Jacksonville contracted Jacksonville University to conduct scientific surveys of manatees in the area, including their feeding behavior and habitat preference, aerial surveys have revealed that the majority of manatee feeding occurs south of the Fuller Warren Bridge. This area, which is separated from Northside Generating Station by Blount Island, is located in a different water channel than the one near the station.

In accordance with the conditions contained in the SLERP issued by the FDEP and the Section 404 Permit for Dredged or Fill Material issued by the COE, the following manatee precautions would be taken during all waterborne construction activities, including dredging and construction of the new dock (Option 2) and materials handling system:

- ***During all in-water construction activities, at least one experienced observer would be designated to watch for manatees. The observer would wear polarized sunglasses to aid in observation. The observer would advise personnel to stop work immediately if manatees were sighted within 50 ft of any in-water construction activity.***
- ***In-water construction work and movement of vessels associated with the project (e.g., work barges) would not occur between sunset and sunrise, when it would be more difficult to spot manatees. The vessels would always operate at "idle speed/no wake" while in the construction***

area and while in waters where the vessel bottoms would be less than 4 ft from the bottom of the water body. All vessels would travel in deep water whenever possible.

- *The construction contractor would instruct all personnel of the potential presence of manatees and the need to avoid collisions with manatees. Construction personnel would be advised of the civil and criminal penalties for harming, harassing, or killing manatees as outlined in the U.S. Marine Mammal Protection Act of 1972, as amended, the Endangered Species Act of 1973, and the Florida Manatee Sanctuary Act. Construction personnel would implement appropriate precautions to protect manatees.*
- *Prior to commencement of construction, the contractor would display at least two temporary signs concerning manatees.*
- *Siltation barriers would be properly secured so that manatees would not become entangled, and the barriers would be inspected at least once daily to avoid manatee entrapment. Barriers would not block manatee entry to or exit from essential habitat.*
- *The contractor would maintain a log during the contract period that documents any sightings, collisions, or injuries to manatees. Any collisions with and/or injuries to manatees would be reported immediately to the Florida Marine Patrol and the FDEP Office of Protected Species Management.*

Potential impacts to manatees resulting from operational activities such as docking of vessels under either Option 1 or 2 would also be unlikely. For example, the potential for manatees to be trapped and pinned between the dock and a vessel would be minimal because the dock would be supported by widely spaced support pilings rather than consisting of one long continuous structure. This design would allow sufficient space between vessels and the dock structure such that manatees could easily avoid being trapped. In addition, a fender/bumper system would be installed at or above the mean high water level to minimize the risk of crushing manatees during vessel docking and mooring. Permanent signs would be installed to alert boaters using docking facilities of the potential presence of manatees, and two "Caution: Manatees" signs would be installed at the pier.

According to Brody (1993), the major threats to manatees in the lower St. Johns River appear to be wounds inflicted by boat propellers and by collisions with boats. The state of Florida has found during its examinations of manatee carcasses that an approximately equal number of manatees are killed by propeller injuries and by collisions, with a much smaller number killed by a combination of these two factors (Ackerman et al. 1995). To help reduce the probability of collisions with boats, several local governments have adopted speed restrictions on boating. While these speed restrictions may help reduce the number of watercraft collisions with fast-moving boats, some manatees are killed by large commercial vessels in the Jacksonville port area. These

vessels rarely operate at high speeds and presumably injure these animals by "drawing" them into their propellers or by crushing them between the hull and river bottom.

Discharge of heated cooling water during operations could potentially impact manatees ***by subjecting them*** to cold shock during the winter if all units were to shut down simultaneously. ***However, the current discharge does not attract manatees because the discharge*** structure is located in the back channel of the St. Johns River where currents are relatively swift***, while*** manatees generally avoid swift currents and prefer slow-moving or stagnant water. In addition, it is very unlikely that all units for both the St. Johns River Power Park and Northside Generating Station would be shut down simultaneously, thereby minimizing the probability that a cold shock event would occur. Moreover, the maximum size of the thermal discharge zone is relatively small (36 acres) for the 4°F temperature elevation (compared with ambient temperature) as specified in the NPDES permit (Section 3.3.4). ***The proposed project would not noticeably alter the characteristics of the thermal plume. Because of the above reasons, cold shock is not an issue of concern. In summary, impacts to manatees from the proposed project would be minimal or non-existent because of a lack of preferred foraging habitat such as submerged seagrasses and a scarcity of emergent cordgrasses in the immediate site vicinity, because of the construction design of the docking facilities, and because manatees are not attracted to the thermal discharge.***

The only other protected species observed regularly on the site is the gopher tortoise, which is usually detected indirectly by its burrows. This species appears to be relatively opportunistic, utilizing a variety of habitats with well-drained soils for its burrows. Because water levels have declined in the wetland areas, the gopher tortoise's burrows have become common in upland areas, particularly in the pine flatwoods and on slopes or berms that are sandy and well drained. Construction activities would be unlikely to occur where burrows have recently been observed. In addition, because a large population of this species exists in Florida (including the site vicinity) and because any dislocation of individuals from their burrows as a result of construction activities would be temporary, re-population would be expected to occur relatively rapidly. A permit would be required from the Florida Game and Freshwater Fish Commission for relocation of gopher tortoises from any impacted areas. Prior to construction, a gopher tortoise survey would be conducted to identify burrows that must be manually excavated, and the animals would be relocated according to conditions of the collecting permit. Section 4.1.6.1 contains additional information concerning relocation of gopher tortoises.

Four or five juvenile loggerhead, Kemps Ridley, and/or green sea turtles were sighted in the Northside Generating Station intake basin on one occasion during the summer of 1997. In order to prevent any further occurrences of juvenile turtles entering the intake structure and subsequently becoming trapped, JEA installed on the intake trash rakes a finer grid of mesh bars (welded wire screen on 6-in. centers contrasted to the old 12-in. centers). The denser grid ***has*** excluded turtles of sizes similar to those observed from entering the intake basin and becoming trapped. One potential problem with this change is that the finer grid could become more easily clogged with trash and attached marine organisms (e.g., barnacles and other biofouling organisms), effectively reducing the cross-sectional area and increasing the water velocity at the intake. In turn, this would increase the vulnerability of free-swimming organisms to entrainment and/or impingement. Therefore, JEA regularly inspects the intake trash rakes to monitor any increased clogging and increases the frequency of cleaning if necessary.

Except for the shortnose sturgeon that is rarely observed in the St. Johns River, the remaining protected organisms discussed in Section 3.6.3 are bird species that use the estuarine systems (i.e., the tidal creeks/salt marsh) adjacent to the site. There should not be observable impacts to these bird species because the proposed project would not adversely affect the ecology of the salt marsh/tidal creeks or the fish in the estuarine systems that are the principal food resource for these predatory birds.

4.1.6.4 Biodiversity

The three major ecosystem types that occur in the site vicinity (terrestrial systems including freshwater wetlands and creeks, salt marsh/tidal creek systems, and the St. Johns River estuary) would not be measurably affected by the proposed project. The St. Johns River estuary, which is the ecosystem most directly linked with the proposed project because it serves as a source of cooling water and is the receiving stream for discharge water, would not experience any appreciable ecological perturbations, including loss of natural shoreline resulting from the proposed project. No proposed construction or operational activities would have the potential to impinge on the normal functioning of the salt marsh/tidal creek system. Construction activities, however, would disturb or remove a small percentage of the existing terrestrial habitat in the site vicinity, primarily pine plantation and upland hardwood/pine. Only about 1.8 acres of hardwood wetland habitat would be affected. Because of the prevalence of these community types in the site vicinity and in northern Florida and the ability of disturbed wildlife species to successfully relocate and recolonize adjacent habitat, impacts of the proposed project on these terrestrial and wetland communities would also be minor. Because none of the ecosystems in the site vicinity would experience any substantial effects from the proposed project, the relatively high species richness and biodiversity would remain unchanged. The large influence of colonizing marine species from the Atlantic Ocean via the St. Johns River and the influx of terrestrial and avian species from surrounding communities would also help to stabilize and maintain a relatively high biodiversity in the site vicinity.

4.1.7 Waste Management

4.1.7.1 Construction

Construction rubble from the proposed project would be trucked off the site to one of two large landfill sites in northeastern Florida that are permitted to dispose of such waste. The landfills are an unnamed site in Nassau County, approximately 20 miles north of Northside Generating Station, and the Trail Ridge site near Baldwin, about 25 miles west of the station. Either of these landfills can easily accommodate the construction rubble.

Under Option 2 for the solid fuel delivery and handling system (Section 2.1.3), the proposed construction of a covered fuel storage enclosure on the south arm of the existing 40-acre dredge spoil storage area would reduce the future dredge spoil storage volume by approximately 114,000 yd^3. However, the fuel storage enclosure would not displace any existing dredge spoil. Construction of the solid fuel and limestone unloading terminal under Option 2 would require deepening the St. Johns River channel. The deepened channel would create 150,000 yd^3 of new dredge spoil. All new dredge spoil would be stored in the somewhat diminished area of the existing dredge spoil site.

At least 30 acres of the existing 40-acre dredge spoil site would remain after installation of the fuel storage enclosure. Storage of 150,000 yd^3 of new dredge spoil on the remaining acres would increase the height of the nearly flat-topped pile by an average of about 3.2 ft. The increased height would not appreciably decrease the stability of the dredge spoil pile. The new height of the dredge spoil pile would have much less visual impact than the proposed nearby 100-ft high combustion ash storage pile.

Under Option 1 for the solid fuel delivery and handling system (Section 2.1.3), the existing dredge spoil area would be unaffected. No construction would occur within the area designated for dredge spoil storage, no existing dredge spoil would be displaced, and no new dredge spoil would be added to the site.

4.1.7.2 Operation

Combustion Ash Management

Uncovered ash would be stored on a 40-acre area in the northwest corner of the Northside property located north of the existing dredge spoil site (Figure 3.4.2). The 40-acre site would consist of cell I (23 acres) in the southern portion and cell II (17 acres) in the northern portion, which are separated by Ostner Road running east-west. Cell I would be filled to its capacity of 2.2 million tons before cell II would be used. If ash marketing were successful, cell II likely would not be needed. If cell II were used, Ostner Road would be relocated around the northern perimeter of cell II, and the combustion ash storage pile in cell I would be extended to the north to form one elongated pile rather than two distinct piles.

The ash storage area would have a double liner, a leak detection system, and a runoff and leachate collection system to prevent impacts on nearby surface water and groundwater. If a leak were detected in the primary liner, a multi-step course of action would be employed, including increased groundwater surveillance and the use of a leachate collection and recovery system. The recovered leachate would be used in the hydration of fresh combustion ash. Because the material would be similar to other cementitious materials in composition and would be compacted, the permeability of the stored hydrated combustion ash would be fairly low. However, because of continued chemical changes (mostly hydration-dehydration reactions) within the ash, it is possible that cracking would occur, which would tend to channel leachate through the stored material. Nevertheless, any leak would be detected and corrected before it would reach the Northside Generating Station property boundary.

Conceptual plans for handling the waste streams expected at the storage area include commingling the leachate and runoff and directing the combined flow to the chemical waste treatment system. The treated effluent from the lined settling ponds would then be pumped to a reuse tank for utilization in the scrubber and ash conditioning processes. Any excess of treated effluent from the system which cannot be reused would overflow into the existing percolation pond for discharge to the surficial aquifer.

It is anticipated that cell I of the storage area would be accumulating combustion ash for at least 1 to 2 years while the market is being developed to match potential customers with one or more of the ash blends resulting from the different mixes of coal, petroleum coke, and limestone that would be used during the demonstration. If no ash were sold during the 2-year demonstration period, cell I would contain between 0.65 and 1.2 million tons of combustion ash from the two repowered units (depending on mixes between 100% coal and 100% petroleum coke, respectively). Because the 23-acre cell I would have a capacity of 2.2 million tons, it could easily accommodate all combustion ash during the demonstration period. Storage site characterization beyond the 2-year demonstration period is discussed in Section 5.

A nationwide survey of CFB ash and its uses indicates that 75% (4.4 million tons of nearly 6 million tons) was used in a variety of applications in 1995 (***Svendsen and Bessette*** 1997). Nearly 82% of the successfully marketed ash was used in mining applications. Other major applications included use for structural fill, waste stabilization, and agriculture. Marketability of CFB ash in northeastern Florida and southeastern Georgia has yet to be determined. Although JEA has initiated a local study, marketing uncertainties would remain until ash characteristics are established.

Data obtained nationwide with regard to leachability and toxicity of CFB ash indicate that none of more than 450 sample analyses exceeded regulatory thresholds (***Svendsen and Bessette*** 1997). EPA's toxic characteristic leaching procedure (TCLP), synthetic precipitation leaching procedure (SPLP), and extraction procedure toxicity test (EP Tox) were among the test analyses performed. EPA's regulatory determination under the Resource Conservation and Recovery Act of 1976 with respect to CFB ash is still pending.

EPA-approved TCLP tests would be performed on Northside Generating Station's CFB ash. Anhydrous and hydrated calcium sulfate (anhydrite and gypsum, respectively) would be the most common constituents of the ash. Anhydrite absorbs water (called water of hydration) to become gypsum. This process is called hydration, and it would take place in the polishing scrubber and an ash conditioner before placement of the ash in the storage area. Anhydrite is converted to gypsum at varying speeds, and some of the conversion would likely continue while the material is in the storage area. Some of the gypsum would leach because of the limited solubility of gypsum. Metals contained in the combustion ash would not be expected to leach because of the conversion of some of the compounds into ettringite, a compound that has the ability to trap many of the metals of environmental concern within its crystalline structure. Any water containing the leached material would be captured and delivered to the Northside Generating Station chemical wastewater treatment facility.

Liquid Waste Management

No major impacts would be expected from the liquid waste streams associated with the proposed project. In addition to the co-mingled stream from the ash storage runoff and leachate collection systems, the chemical waste treatment system would treat demineralizer and condensate polisher spent regenerant and rinse water (with total dissolved solids of approximately 14,500 mg/L and a pH of about 1.6), boiler and air preheater washes, boiler blowdown, and washdown water from equipment and floor drains. The average quantity of treated wastewater currently discharged through the evaporation/percolation ponds to the surficial aquifer is about 286 gpm (Figure 2.1.9). For the proposed project, about 333 gpm of chemical waste treatment water would be routed from the settling basins to a new reuse tank (Figure 2.1.8). A new filtration unit would receive this water in addition to any designated reuse water from the St. Johns River Power Park. Most of the wastewater from the filtration unit (213 gpm) would be directed to the new dry scrubbers, where it would either evaporate and exit through the stack to the atmosphere or combine with anhydrite to form gypsum combustion by-products. Only 48 gpm of effluent from the chemical waste treatment system would be routed from the settling basins to the existing evaporation/percolation ponds unless the reuse tank becomes filled to capacity. An estimated 127 gpm from the new ash storage area runoff and leachate collection systems would be directed to the chemical waste treatment system.

4.1.8 Cultural Resources

Because the area in the vicinity of the proposed project is rich in archaeological resources (Section 3.7) ***and*** the excavation of undisturbed land could affect important archaeological artifacts, ***a cultural resources assessment survey of the proposed project site and a follow-up Phase II investigation were conducted in the spring of 1999 (Florida Archeological Services 1999a,b). These studies found that there are no potentially significant historic or archaeological sites located in the area that would be disturbed by the proposed project. Consequently, no significant impacts to onsite cultural resources are expected to occur as a result of project construction.***

The proposed project would require a SLERP that would be issued by the FDEP. Northside Generating Station is located within the St. Johns River Water Management District (SJRWMD), whose rules specify that SLERPs include a condition requiring the permittee (JEA in this case) to notify the district immediately upon the discovery of any archaeological artifacts on the project site [Rule 40C-4.381(1)(r), Florida Administrative Code]. As the FDEP is bound by SJRWMD rules in issuing the SLERP for the proposed project [Rule 62-330.200(2)(c), Florida Administrative Code], that permit would contain a condition requiring JEA to notify the appropriate agencies [the SJRWMD, the FDEP, and the State Historic Preservation Officer (SHPO)] immediately upon discovery of any archaeological artifacts on the project site.

Away from the immediate site, it is extremely unlikely that the project would result in the disturbance of major cultural or archaeological resources, because agricultural or vacant land or other unbuilt areas would not be converted to residential, commercial, industrial, or public facility uses (Section 4.1.1.1).

4.1.9 Socioeconomic Resources

At their own risk, JEA has begun initial construction activities without DOE funding. Construction would take approximately two years and, consistent with the original JEA schedule, would be completed in December 2001. Workforce projections provided by JEA cover the repowering of both Units 1 and 2 at Northside Generating Station. Work on both units would be ongoing during the same time period, but the activities at Unit 2 would precede the same activities at Unit 1 by 4 to 6 months. Approximately ***820*** construction workers would be employed onsite during the peak construction period, which would last ***for about 3 months in late 2000 and early 2001.*** Many different crafts would be required for project construction, with the largest numbers being boilermakers, pipefitters, plumbers, ironworkers, and electrical workers.

In addition to the jobs that would result directly from project construction, a number of indirect and induced jobs would be created as a result of the purchases of goods and services by JEA and the ***820*** construction workers. According to the RIMS II multipliers developed by the U.S. Bureau of Economic Analysis (1992), each direct job in new construction in Florida leads, on average, to the creation of 1.1 indirect and induced jobs, for a total of ***approximately 900*** new workers (in addition to the ***820*** construction positions).

Because of the substantial size of the Duval County workforce (Section 3.8.2), it is likely that all or most of the workers needed for this project would come from the local area. However, to reflect the possibility that there could be some local shortages of particular crafts at the time of proposed construction, it is assumed that up to 25% of the direct workforce (***205*** workers at peak) could move to Duval County during the construction period. It is likely that the actual number of in-migrating construction workers would be substantially less than ***205***, but that number is used throughout this analysis as a reasonable upper bound. Past experience (USNRC 1996) indicates that approximately 60% of inmovers (i.e., ***123*** workers) would be accompanied by families, while the remaining 40% (***82*** workers) would not be accompanied by family. If the inmoving construction workers have an average family size of 3.1—the average for Duval County (U.S. Bureau of the Census 1991)—the local population would increase by ***463*** residents in ***205*** households as a result of direct employment.

Indirect jobs generally are less specialized than direct jobs and would be more likely to be filled by existing area residents. Accordingly, no more than 10% of the indirect workforce (i.e., ***90*** workers at peak) is assumed to move to the impact area during the construction period. Once again assuming that 60% of inmovers (***54*** workers) would bring families and that their average family size would be 3.1, an upper bound estimate of ***203*** new residents in ***90*** households would result from indirect employment during the construction period.

Combining direct and indirect construction-period in-migration yields a total of ***666*** new residents in ***295*** households as an upper bound. Based on ***177*** new families (***123*** direct and ***54*** indirect) and the Duval County average of 0.74 school age children per family (U.S. Bureau of the Census 1991), about ***131*** additional children would be added to the local schools.

Plant operations would begin in early 2002, with a 2-year demonstration period. In 2004, commercial operations would ensue and would last until about 2032. The workforce required for plant operations would be substantially less than for project construction. A total of 74 operations workers and 64 maintenance workers would be required for Units 1 and 2 combined, plus another 12 employees for management, engineering, and administration. Existing employees would be used to operate and maintain the repowered units. Approximately one-half of these 150 workers would be required for each unit, meaning that Unit 2 would employ about 75 workers. Although operations workers would be required 24 hours a day, other employees would work primarily during the day shift. Approximately four contract truck drivers also would be needed to haul away plant byproducts. In addition to these year-round employees, ***about 100 to 200*** contract workers per unit would be required for 3 to 4 weeks each year to perform maintenance duties associated with each unit's annual outage ***(outages would be scheduled so that they don't overlap)***, and ***the same number of*** contract workers per unit would be required for ***9 to 16*** weeks during each unit's major outage occurring every ***5 to 10*** years. ***No maintenance outages would be scheduled at Northside Generating Station during the peak construction period in late 2000 and early 2001.***

As in the construction period, direct operations jobs would create indirect and induced employment. Because each direct job in the electric utility industry in Florida stimulates the creation of 2.5 indirect positions, on average (U.S. Bureau of Economic Analysis 1992), the 75 year-round operations and maintenance positions would normally result in about 188 new indirect and induced jobs. In actuality, this project probably would create fewer than 188 indirect and induced jobs because the 75 direct workers for Unit 2 are already employed at Northside Generating Station and are currently supporting some local service jobs. However, a substantial portion of the employment multiplier for the electric utility industry results from the purchase of equipment, materials, and support services that are necessary regardless of whether current plant workers are new to the community. Accordingly, this analysis assumes the need for 188 indirect and induced workers as an upper bound, acknowledging that the actual number of workers is likely to be somewhat less.

The four contract truck driving positions would sustain an additional four indirect jobs, reflecting the fact that the multiplier for direct transportation employment is substantially lower than for the utility sector. Another ***500*** indirect and induced jobs could theoretically be created during annual and major outages. In practice, however, these outages would be so brief that little, if any, local job creation would be likely to occur. Altogether, the number of direct and indirect jobs created during the operations period would be substantially less than during construction.

All 75 year-round jobs associated with Unit 2 would be filled by existing workers from JEA's employee pool, which is based at Northside Generating Station. Similarly, all four contract truck driver positions could easily be filled from the local labor pool. Accordingly, no year-round workers would be expected to move to the local area. Using 25% in-migration of new contract maintenance workers as an upper bound, up to ***50*** temporary employees could move to Duval County during annual ***and major*** outages. If 60% of these inmovers are accompanied by families with an average family size of 3.1, the local population would temporarily increase by ***113*** residents in ***50*** households as a result of direct employment during outages. These population increases would be very brief and much smaller than those experienced as a result of direct construction employment.

Assuming that 10% of the ***year-round*** indirect jobs created during the operations period could not be filled by current residents of Duval County, about 19 year-round workers could be added to the local population. Up to 75% of these could be accompanied by families (as opposed to 60% during construction) because the lengthier operations period would tend to encourage more workers to bring their families with them. Thus, the year-round local population could increase by 49 people in 19 households, and additional growth could theoretically occur during outages (although the brevity of these outages suggests that substantial indirect job creation would not occur). In actuality, *no* population growth would be expected to occur as the result of indirect employment during plant operations because the number of indirect jobs would be substantially fewer than during construction. The net effect of moving from construction to operations, therefore, would be a job *loss* and a slight population decline, unless the displaced workers find employment elsewhere in the local area.

The direct and indirect year-round jobs created during operation of the repowered Unit 2 could cause as many as 49 people in 19 households (with 11 school age children) to move to Duval County. Up to another ***113*** people in ***50*** households could come to Duval County briefly as a result of plant outages. Even with these temporary influxes, the number of project-related residents of Duval County would be substantially less during plant operations than at the time of construction.

4.1.9.1 Population

The large majority of any in-migrating workers would probably settle in Duval County because of its abundance of available housing and services. The ***666*** new construction-period residents assumed in this analysis as an upper bound would represent an increase of only ***0.09%*** to the population projected for Duval County in 2000. During the operations period, the 49 new year-round residents would account for only 0.006% of Duval County's population. Even during the ***periodic*** outages that would occur throughout the operations period, project-related residents would make up only ***0.02%*** of the Duval County population.

4.1.9.2 Employment and Income

During the peak of construction activity, the ***1,720*** additional jobs that would be generated by the proposed project represent ***0.4%*** of the total number of jobs in Duval County in 1996. Year-round employment during the operations period would be substantially less, with the 271 positions associated with the Unit 2 repowering amounting to 0.07% of the 1996 Duval County workforce. Accordingly, construction of the proposed project would have a small positive effect on local employment, while a small net loss of employment would occur during project operations because the number of year-round operations jobs would be less than the number of construction jobs that would be lost.

Because the skilled craftspeople required during plant construction would probably earn more than the average worker in Duval County, mean income in the county could experience a slight increase. During the operations period, a continuation of this increase would be unlikely, because construction employment would end and all 75 workers required for plant operations would be expected to come from the existing pool of JEA workers.

4.1.9.3 Housing

The ***295*** new construction-period households assumed as an upper bound in this analysis would represent ***1.7%*** of the vacant housing units that were for sale or rent in Duval County in 1990 (the most recent year for which comprehensive data are available). During operations, the 19 new year-round housing units required by project-related workers would account for 0.1% of vacant sale and rental units, and this number would climb to only ***0.4%*** during outages. Accordingly, any housing impacts would be very small during both the construction and operations periods.

4.1.9.4 Local Government Revenues

The amount of revenue received by the consolidated city of Jacksonville would increase with increased sales of electricity because JEA makes in-lieu-of-tax payments to the city based upon kilowatt hours sold. On a JEA systemwide basis, the increase in revenue to the city would be slight as the demand for electricity provided by JEA slowly increases with time. In addition, local purchases of materials needed during project construction and operations would result in additional sales tax receipts for the communities in which the purchases are made. The overall effect of these revenue increases, while positive, would be minor.

4.1.9.5 Public Services

Education

The addition of ***131*** new school-age children during the construction period would increase enrollment in Duval County's public schools by only ***0.1%*** (Section ***3.8.5.1***). Distributed evenly over all public schools in the county, such an increase would mean an average of ***0.8*** students per school. Accordingly, impacts to education would be very small. The impacts during the operations period, when there would be up to 11 new students, would be even less than during construction.

Utilities

The relatively small number of new households and residents that would come to Duval County as a result of construction and operation of the proposed project would not affect the ability of local water and sewer systems to provide adequate services, especially in light of the ongoing and planned improvements described in Section 3.8.5.2. Therefore, any impacts to utilities would be very small.

Police and Fire Protection

Local police and fire protection capabilities (Section 3.8.5.4) would not be strained by the relatively small number of new residents that would move to Duval County as a result of the proposed project. Accordingly, any impacts would be very small.

4.1.9.6 Environmental Justice

Section 3.8.6 indicates that the percentages of Blacks and Asians living in Duval County are greater than for the state as a whole, but that there are relatively few members of these ethnic groups living in the census tracts surrounding the proposed site. The percentage of people living below the poverty level is slightly less in Duval County than in all of Florida, and the percentage of the population living in poverty is substantially less in the census tracts surrounding the proposed site than it is for the county or the state. Accordingly, no disproportionately high and adverse impacts to minority or low-income populations would be expected from construction or operation of the proposed project. In particular, because of the relatively low number of minority and low-income residents in the vicinity of the proposed project, very few members of these groups would experience the adverse effects associated with increased road and rail traffic (Section 4.1.10.1) and related noise (Section 4.1.10.2).

4.1.10 Transportation and Noise

4.1.10.1 Transportation

Roads

All 820 workers expected during the peak construction period ***would use the rear entrance to Northside Generating Station on Ostner Road, which is accessed*** from New Berlin Road ***(Figure 2.1.7)***. Construction activities would be conducted during a single shift during daylight hours. At peak, there may be ***820*** daily round-trips by passenger vehicles transporting construction workers to and from the site. In addition, concrete and small equipment would be brought to the site by truck. ***Most of*** these deliveries, which would normally occur between 9:00 a.m. and 3:00 p.m., would be made via the ***rear*** entrance. ***Concrete trucks would occasionally use the main entrance from Heckscher Drive.***

Construction-induced traffic during the peak hour would not exceed available capacity for four of the five road segments shown in Table 3.9.1, although speed and maneuverability ***are likely to be substantially*** diminished ***on New Berlin Road. Available capacity is expected to be exceeded on*** the section of Heckscher Drive from State Route 9A to Drummond Point (just west of Eastport Road). This segment currently operates at an LOS of E and has an available capacity of 89 trips per hour during its peak period. A recent traffic impact analysis performed for JEA (Robinson Engineering Group 1998b) predicts that 19% of peak hour project-related traffic would use this road segment during the construction period. Using the conservative assumption that all ***820*** workers would drive themselves and would all leave the plant during the peak traffic hour, an additional ***156*** vehicles would use this segment during its time of highest use, thereby exceeding its remaining capacity. The congestion experienced on this segment would represent a significant impact during the peak construction period. Consequently, JEA has agreed to encourage carpooling and suggest alternate routes to and from the site (R. Comer, JEA, letter to J. Hebb, DOE, March 31, 1999).

The addition of 820 passenger vehicles carrying construction workers on New Berlin Road during the peak hour would use nearly all available capacity on the segment (Table 3.9.1) and would noticeably increase traffic congestion, especially at the intersection of Ostner and New Berlin Roads. To avoid a significant impact, JEA has agreed to monitor traffic at the above-mentioned intersection and to place a police officer at the intersection to direct traffic during peak times, if needed. Should the presence of a police officer prove inadequate to control project-induced traffic, JEA has further agreed to pursue authorization of a temporary traffic signal at that intersection (J. A. Leduc, JEA, personal communication to R. L. Miller, ORNL, January 28, 2000).

The additional number of vehicles on local roads during plant operations would be considerably less than during the construction period. As explained in the introduction to Section 4.1.9, the year-round workforce for Unit 2 would amount to only 75 operators and maintenance workers plus 4 contract truck drivers, in contrast to the ***820*** workers expected during the peak construction period.

All workers would be expected to use the main entrance on Heckscher Drive; but only a portion of the total workforce would be on the site during any single shift, and most of these workers are already stationed at Northside. Even during plant outages, ***no more than 200*** additional workers would be on the site, which would be ***less than 25%*** of the peak construction number of ***820***. Because of the relatively few vehicles involved during plant operations, any impacts to traffic flow on Heckscher Drive, ***New Berlin Road***, and other nearby roads would be very minor.

In addition to the passenger vehicles driven by operations workers, there could be up to 93 round-trips per day by heavy trucks carrying limestone from the waterfront area of Jacksonville to Northside to serve both repowered units. Although the limestone could be trucked to the St. Johns River Power Park and transported from there to the Northside facility by conveyor, it is more likely that the trucks would come directly to Northside's back entrance ***on Ostner Road.*** It is likely that fewer than 93 daily truck trips would be required because at least some portion of the limestone would probably be delivered via water. In fact, under Option 2 (Section 2.1.3), the limestone would be delivered entirely by ship. Up to another 56 truck trips per day could be required to remove ash generated by both repowered units from the site, and these trucks would also use the back entrance (Robinson Engineering Group 1998b). The anticipated volume of heavy truck traffic would increase the wear and tear on local roads and could accelerate the need for repairs. The maximum number of daily truck trips (i.e., for limestone and ash combined) would be well below the available capacity on New Berlin Road in the vicinity of the facility, but there could be some adverse effects to the rate and quality of flow on that road segment if all or most of those trips occurred during the periods of heaviest traffic. In actuality, those trips would more likely be spread out during the working day, so any impacts would probably be very small.

Rail

Based on current economic projections, marine transportation would be the primary means of delivering solid fuel and limestone for the proposed project. Consequently, no more than one 90-car unit train per week would be required to transport coal for the proposed project, and this could be offset by decreased rail deliveries and corresponding increased waterborne deliveries for operations at the St. Johns River Power Park. However, in the less likely event that all necessary coal would be transported by rail, up to 3 additional trains per week would be required for a total of 6 new one-way trips by 90-car unit trains. The coal would come initially to the St. Johns River Power Park and would be sent from there to Northside Generating Station by a new elevated conveyor. The short rail line that runs parallel to the eastern edge of the Northside property would not be used for fuel delivery because it is not near the proposed solid fuel storage area and because it lacks fuel-unloading facilities. If all coal were transported by train, the 6 new one-way train trips per week could exacerbate the problems experienced by nearby residents with noise, vibration, and blocked roads at on-grade rail crossings resulting from existing train traffic. ***The 6 additional one-way trips***

per week would increase total movement on the CSX line paralleling U.S. 17 by about 5% and would increase traffic on the spur line from U.S. 17 to the St. John River Power Park and Blount Island by approximately 8% (Robinson Engineering Group 1998a).

Marine

Based on current economic projections, most solid fuel and limestone for the proposed project would arrive by water. There are two options under consideration for moving waterborne solid fuel and limestone to Northside Generating Station. Option 1 is to bring these materials to the Power Park's unloading facility on the south side of Blount Island, transport them by existing conveyor to the Power Park, and send them on to Northside Generating Station by a new elevated conveyor. The existing unloading facility would have to be expanded to handle these additional shipments (Section 2.1.3). Option 2 is to ship these materials to an upgraded unloading facility that would replace Northside's existing oil unloading facility on the north shore of the St. Johns River back channel. From there, materials could be moved to the project site by a new elevated conveyor. Neither of these options would be likely to have adverse impacts on current marine traffic or unloading operations because existing waterways would be adequate to handle the increase in ship and barge traffic, and the construction of new or expanded unloading facilities would prevent existing operations from being degraded. However, excavation for new conveyors could potentially disturb archaeological resources (Section 4.1.8).

4.1.10.2 Noise

Northside Generating Station currently operates within the city's noise ordinance, which protects public health, comfort, and safety (Section 3.9.2). During construction of the proposed project, noise levels would increase from the present operational levels. Construction would primarily occur adjacent to the existing turbine building. The noisiest periods of construction would be during steam blowouts and during the operation of a pile driver and other construction equipment. ***If JEA conducts high-pressure steam blowouts without installing mufflers,*** noise from ***the*** blowouts could exceed the limitations of Rule 4, Noise Pollution Control, promulgated by the Jacksonville Environmental Protection Board (1995), which limits daytime construction noise levels to ***an Leq of*** 65 dB(A) at residential property.

Steam blowout is a procedure in which the steam lines in the facility would be cleared of debris by blowing them out with steam prior to plant start-up. ***JEA likely would perform continuous, low-pressure, high-velocity steam blowouts. Although this activity would be conducted around the clock, noise levels at the nearest residences should be below levels of concern with this type of blowout that uses low-pressure steam rather than high-pressure steam. However, because JEA's steam blowout plan has not been finalized, JEA has committed to installing mufflers if high-pressure steam blowouts are conducted or, if mufflers are not installed, has committed to***

measuring the noise levels at the nearest residences to ensure that the levels would conform to the Noise Pollution Control ordinance limits (J. A. Leduc, JEA, personal communication to R. L. Miller, ORNL, February 10, 2000).

High-pressure steam blowouts without mufflers would generate the highest noise levels associated with plant construction, 129 dB(A) at 50 ft (EPA 1977). ***If JEA conducts high-pressure steam blowouts, they would be conducted for up to 10 days for each of the repowered units before start-up, and then would occur for up to several days only once every 5 to 10 years during major plant maintenance outages. A typical sequence would be to conduct several steam blowouts per day for several days during the period; the duration of each steam blowout would be about 3 min and the interval between blowouts would be no less than 30 min.***

High-pressure steam blowouts produce noise that is directional. Along the direction of maximum noise, the level ***(without mufflers)*** should be reduced to about 99 dB(A) at 1,600 ft ***(the distance to the nearest residences)*** under normal atmospheric conditions. For other directions, noise levels would be substantially below 99 dB(A) at 1,600 ft. Wind direction and speed and other atmospheric conditions can affect these noise levels. In addition, a face of a building or other structure can reflect noise and affect both the intensity and direction of noise. Short exposures to the highest anticipated levels should not result in permanent hearing loss, but they would be uncomfortable. Exposure to 3 min of noise at approximately 100 dB(A) can result in a short-term threshold shift (a temporary shift in the hearing threshold, or lowering of sensitivity) of about 5 dB(A); the time required for complete recovery ranges from a few hours to overnight (Kryter 1985).

Because of the noise associated with ***high-pressure*** steam blowouts ***without mufflers***, JEA has historically implemented a public awareness program prior to implementation of steam blowouts and would do so during the proposed project, ***if necessary***. The program includes advance notification to the media; police, fire, and rescue agencies; and local regulatory and governmental agencies. The ***program has*** generally been effective in alerting the public ***through newspaper and radio announcements***, but some calls from concerned individuals are typically received by the above agencies and are anticipated during steam blowouts. The agencies, having been advised of an upcoming ***high-pressure*** steam blowout, would be able to describe the noise's source and projected duration and frequency to the concerned individuals. JEA would also notify beforehand all residences within 0.5 mile of the high***-pressure*** steam cleaning operation. This advisory would alert people to go inside to reduce the effects of the noise. ***The number of residents affected within the 0.5-mile radius would be less than 100.*** As a mitigation measure, only daytime ***high-pressure*** steam blowouts would be permitted. No Sunday ***high-pressure*** steam blowouts would be allowed.

One pile driver operating intermittently would produce peak noise levels of about 101 dB(A) at a distance of 50 ft as the hammer impacts the pile (EPA 1971). This level would dissipate to about 83 dB(A) at 400 ft. For a brief period under Option 2 associated with constructing a new solid fuel unloading terminal (Section 2.1.3), pile driving related to constructing the conveyor would occur only 400 ft from the nearest residences. Under Option 1, no new conveyor would be built near residences. The noise level would dissipate to about 71 dB(A) at 1,600 ft, the distance to the nearest residences southeast of the existing turbine building where most of the pile driving would occur. As a mitigation measure, JEA would use an enclosure technology or a less noisy type of pile driving (e.g., the vibratory method), as necessary, to ensure that the noise level would not exceed 65 dB(A) at the nearest residences.

Because the nearest residences are approximately 1,600 ft southeast of the existing turbine building, the residences would experience increased noise levels as a result of construction equipment and increased vehicular traffic, particularly during the beginning and end of construction shifts. Maximum additional traffic may approach ***820*** vehicles daily as a result of the commute of the construction crew and delivery of construction materials. The peak would occur ***for about 3 months in late 2000 and early 2001***. Other construction noise generated by earthmoving equipment, trucks, tractors, and cranes would likely be in the range of 90–95 dB(A) ***(Leq)*** at a distance of 50 ft from the construction site, approximately 68–73 dB(A) at 400 ft, and approximately 56–61 dB(A) at 1,600 ft (EPA 1971). Existing background noise levels at locations considered to represent sensitive noise receptors are in the range of 55–60 dB(A) ***(Leq)*** during the daytime (Section 3.9.2) (JEA 1998a,b).

In summary, except ***possibly*** during steam blowouts and possibly during operation of equipment used to construct a segment of the conveyor 400 ft from nearby residences under Option 2, construction noise should not appreciably affect the background noise of nearby residences, interfere with outside voice communications, or exceed the limitations of Rule 4, Noise Pollution Control, promulgated by the Jacksonville Environmental Protection Board (1995). Nighttime levels should remain almost the same as existing levels because construction would occur predominately during the daytime.

Normal operation of the proposed facility would produce a similar type of noise to that currently experienced. The dominant noise would be a low-frequency hum. The major sources of noise from the facility would be the large, primary and secondary air fans and the induced draft fans required to provide air to the combustor and to move exhaust gases through the emission control system and out the stack. There also would be numerous smaller noise sources, including the coal and limestone crushers. Specific equipment has not yet been selected, but all of the major equipment has been sized and bid packages that include noise data have been received for the equipment that would be the major sources of noise. Because the facility would burn coal and petroleum coke rather than natural gas and oil and because the electrical generating capacity would increase, an analysis was performed to quantify operational noise levels.

Noise modeling was performed using the NoiseCalc computer model developed by the New York State Department of Public Service (Driscoll 1985). Model input included the noise data received from the bid packages for the major sources and noise estimates obtained for the smaller sources (BBN 1984). Modeling results indicated that mitigation measures, including installing baffle silencers for the fans and enclosing the coal and limestone crushers in a sound-insulating building, would be necessary to reduce noise levels to comply with the city of Jacksonville noise ordinance level of 60 dB(A) ***(Leq)*** at any residence (Foster Wheeler 1998c). The mitigation measures ensure that noise would not exceed 85 dB(A) at a distance of 3 ft from the equipment. The mitigation measures are conceptual because the design has not been finalized, but the analysis demonstrates that the proposed project could be designed so that noise ordinance levels would not be exceeded at any residence.

Based on implementing the mitigation measures, ***noise levels (in Leq) from the proposed project predicted by the model*** in each of four directions around the facility (at distances corresponding to the nearest residences) are as follows: 48 dB(A) to the north, 50 dB(A) to the east, 59 dB(A) to the southeast, and 57 dB(A) to the west. Because noise attenuates with distance, noise levels would be lower at other residences. The highest level would occur at the residences to the southeast, which are also the nearest residences overall (1,600 ft from the existing turbine building). Noise levels at the residences to the east would be reduced by shielding from the existing turbine building. ***Because the proposed facility would be used during commercial operation as a baseload unit operating 24 hours per day at the 297.5-MW level for 90% of the time during the year, noise levels attributable to operation of the facility would be independent of time of day. The estimated levels are similar to and perhaps less than ambient levels (Section 3.9.2) because ambient levels are often dominated by other sources of noise, particularly from vehicles.*** The modeling results indicate that operation of the facility would comply with the city of Jacksonville noise ordinance level of 60 dB(A) ***(Leq)***.

As noted in Section 3.9.2, the high decibel levels associated with rail traffic through the nearby area are a source of concern for residents of Panama Park, North Shore, and San Mateo. As discussed in Section 4.1.10.1, if all coal for the proposed project were transported by train, total movement on the CSX line paralleling U.S. 17 would increase by about 5% and traffic on the spur line from U.S. 17 to the St. Johns River Power Park and Blount Island would increase by approximately 8%. Accordingly, the number of times that local residents would be subjected to loud noise from train whistles and rattling rail cars would increase by the same amount. Additional train traffic could be minimized by relying more heavily on barges and ships for coal transport. As mentioned earlier, economic projections indicate that this fuel delivery mode would be more likely.

4.1.11 Electromagnetic Fields

Over the past two decades there has been concern by some members of the scientific community and the public regarding human health effects from electromagnetic fields during the transmission of electrical current from power plants. In spite of efforts by the scientific community and funding from governmental agencies and private organizations, the issue is still clouded with much uncertainty.

Small effects are indicated in some studies and none in others. Based on a comprehensive evaluation of published studies regarding the effects of electric and magnetic fields from power plants on cells, tissues, and organisms (including humans), there is no conclusive and consistent evidence that exposures to residential electric and magnetic fields produce cancer, adverse neurobehavioral effects, or reproductive and developmental effects (NRC 1997). An association between residential wiring configurations and childhood leukemia is evident in multiple studies, although the cause for that statistical association has not been identified. No evidence from recent measurements links magnetic fields to childhood leukemia (NRC 1997). Until more definitive answers become evident, little can be said with regard to the conclusions of these studies other than effects, if present, are small.

For the proposed project, electrical fields would not change from existing levels because the voltage would not change. However, magnetic fields within the transmission corridors would scale proportionally with the added transmitted power. The majority of consumers receiving electricity from the proposed facility would not experience any change in exposure levels to electromagnetic fields because the fields would be confined to areas along the transmission corridors.

4.1.12 Human Health and Safety

Potential health impacts to workers during construction of the proposed project would be limited to normal hazards associated with construction (i.e., no unusual situations would be anticipated that would make the proposed construction activities more hazardous than normal for a major industrial construction project). Most accidents in the construction industry result from overexertion, falls, or being struck by equipment (NSC 1994). Construction-related illnesses would also be possible (e.g., exposure to chemical substances from spills). Workers would be protected by JEA’s Safety and Occupational Health Program, which incorporates the numerous health and safety procedures and policies required by OSHA, the state of Florida, and JEA.

The Bureau of Labor Statistics estimated that the 1992 incidence rate for total cases of occupational injury and illnesses resulting from construction activities was 13.1 per 100 worker-years (NSC 1994). Total cases include all work-related deaths and illnesses and those work-related injuries that result in loss of consciousness, medical treatment other than first aid, restriction of work or motion, or transfer to another job. In comparison, Foster Wheeler Constructors, Inc., recorded an annual rate of 2.2 per 100 worker-years for total cases during the 3-year period 1995–97 (Foster Wheeler 1998d). Based on this rate, the total number of cases of occupational injury and illnesses resulting from the proposed construction would be approximately 15 for the 650 person-years of construction.

Following the repowering of Unit 2 and the related action of repowering the existing Unit 1, the total number of employees at Northside Generating Station would decrease by about 10% through attrition from the current level of 265 to about 238 workers (Section 2.1.5). This change is relatively minor. The overall design, layout, and operation of the facilities would minimize human hazards.

Compliance with the Federal Occupational Safety and Health Standards as well as safety standards specified by the Industrial Safety Section of the Florida Department of Commerce would maintain the current occupational safety record at Northside Generating Station. No substantial differences with respect to occupational safety or industrial hygiene would be expected between current operations and those of the proposed project. Thus, there should be a very similar occupational safety and health experience during future operations.

Potential health impacts to the public from the proposed project include fugitive dust typical of construction sites (Section 4.1.2.1), operational combustion emissions from the proposed facility (Section 4.1.2.2), blocked roads delaying emergency vehicles at on-grade rail crossings (Section 4.1.10.1), noise (Section 4.1.10.2), and electromagnetic fields (Section 4.1.11). Programs in place at JEA are designed to minimize public and employee health and safety risks during project construction and operation.

4.2 POLLUTION PREVENTION AND MITIGATION MEASURES

Pollution prevention and mitigation measures have been incorporated by JEA as part of the design of the proposed project. The CFB technology would remove up to 98% of SO_2 emissions, reduce NO_x formation by approximately 60% compared with conventional coal-fired technologies, and remove more than 99% of particulate emissions. JEA plans to sell the proposed project's combustion ash as a by-product to offsite customers. In addition, mitigation measures have been developed to minimize potential environmental impacts associated with the construction and operation of the facilities. Table 4.2.1 lists the pollution prevention and mitigation measures that JEA would provide during the construction and operation of the proposed project.

4.3 ENVIRONMENTAL IMPACTS OF NO ACTION

Under the no-action alternative, DOE would not provide cost-shared funding for the proposed CFB combustor project. Consequently, three reasonably foreseeable scenarios could result (Section 2.3.1).

First, JEA could repower the existing Unit 2 steam turbine without DOE funding, thereby accepting more of the risks associated with demonstrating the CFB combustor. Construction materials and activities and project operations would be the same as for the proposed project. The same amount of electricity would be generated and environmental impacts would generally be very similar to those of the proposed project. Fuel requirements would be similar except that the blend of coal to petroleum coke might be slightly different, particularly during the first 2 years of operation. Under this scenario, more of the solid fuel used each year throughout the lifetime of the facility could be petroleum coke, which would be brought to the site by waterborne transport. Compared with the proposed project, the increased use of petroleum coke under this scenario would result in less train traffic and more ship traffic to deliver the fuel (particularly if current projections change

Table 4.2.1. Pollution prevention and mitigation measures developed for the proposed project at Northside Generating Station

Environmental issue	Pollution prevention or mitigation measure
Land use	The proposed project would be constructed to minimize impacts to the number, density, and species types of trees. As a mitigation measure, the planting of trees to replace those removed during construction is required under the city of Jacksonville's tree protection regulations. JEA would supply replacement trees from their tree farm to the local civic association for the latter to use wherever needed to implement the community's beautification program.
Atmospheric resources and air quality	During construction, vehicles and machinery would be equipped with standard pollution-control devices to minimize emissions. Dust suppression measures (i.e., watering) would be used to minimize the occurrence of fugitive dust during construction activities. During operation, the handling and transfer of coal, petroleum coke, and limestone at the site would generate PM-10 emissions. To reduce these emissions to acceptable levels, the proposed project would minimize the number of handling and transfer points, enclose the conveyors and material unloading points, use wetting systems for particulate suppression, and install collection devices such as baghouses. The circulating fluidized bed (CFB) combustor would use limestone injection to remove sulfur dioxide (SO_2). A polishing scrubber on the flue gas stream would further remove SO_2. Compared with conventional boilers, the CFB combustor would produce less amounts of oxides of nitrogen (NO_x) because of its lower flame temperature. Selective non-catalytic reduction technology would be incorporated in the proposed project to further reduce NO_x formation. Emissions of particulate matter from the CFB combustor would be controlled using an electrostatic precipitator or a baghouse filter system. JEA has committed to reduce maximum hourly SO_2 emissions from the existing Unit 1 by nearly 93% when operations commence for the proposed project. This reduction would be accomplished by using a blend of natural gas and fuel oil with an SO_2 emission rate averaging no more than 0.143 lb/MBtu (effectively, a blend with a sulfur content averaging no more than 0.13%). ***DOE is not proposing any project-specific mitigation measures for carbon dioxide emissions. In other programs, however, DOE is studying potential mitigation measures such as enhanced carbon sequestration. Further research and development are needed to determine the feasibility of such measures.***

Table 4.2.1. Continued

Environmental issue	Pollution prevention or mitigation measure
Surface water resources	During construction, standard engineering practices such as straw berms, liners, cover materials, and grading would be implemented as required to minimize runoff, erosion, and sedimentation near the site. Accidental spills of construction materials such as solvents, paint, caulk, oil, and grease that could contain hazardous substances would be cleaned up in a timely manner and in accordance with a spill prevention, control, and countermeasure plan. Runoff from facilities that would be built as part of the proposed project would be used in plant processes or routed through detention basins equipped with baffles or oil skimmers before being discharged at stormwater outfalls. The detention basins would reduce the maximum rate of stormwater discharge by increasing the length of time during which the discharge occurred. The baffles or oil skimmers would collect contaminants such as oil and grease that float on top of the stormwater. Accidental spills from the proposed facility would be cleaned up in a timely manner in accordance with a spill prevention, control, and countermeasure plan and the best management practices plan for the facility. Tanks containing liquids such as fuel oils, waste oils, turbine lubrication oils, and fuel additives are either (1) surrounded by berms or dikes that would contain accidental leaks or spills, or (2) have controlled drainage areas whose runoff is routed to and collected in sumps. The sumps are piped into the wastewater treatment system. Rapid cleanup of any liquid impounded by secondary containment that did not enter the wastewater treatment system would minimize seepage into the groundwater. Impacts associated with transfer piping failure or leakage would be minimized because (1) the piping is routinely inspected on a daily basis and more frequently while pumping is in progress, and (2) most pipeline failures manifest themselves as small-scale, gradually increasing leaks that would be detected during routine inspection before excess leakage would impact the environment.
Geological resources, groundwater	The currently unlined settling basins would be lined for the proposed project, and the supernatant from the settling basins would be routed to the reuse tank. On an occasional basis when the reuse tank is full, the overflow from the settling basins would be directed to the existing evaporation/ percolation ponds and consequently to the surficial aquifer.

Table 4.2.1. Continued

Environmental issue	Pollution prevention or mitigation measure
Geological resources, potential for subsidence	Geotechnical site investigations would precede construction of any new major structures associated with the proposed project. Such investigations would be designed to reveal any solution cavities within 100 ft of the surface that could cause the surface to collapse or subside appreciably. If a cavity were detected, collapse and subsidence at the surface would be prevented by filling the cavity.
Floodplains	The land occupied by and immediately surrounding the repowered units would be sloped to promote drainage away from structures.
Wetlands	Judicious placement of facilities would minimize potential impacts on wetlands. The site for the ash storage area includes a 200-ft buffer zone extending to the San Carlos Creek floodplain, which would minimize or avoid any impacts to the San Carlos Creek system. To offset the loss of 1.8 acres of hardwood wetlands during construction of the ash storage area, JEA would purchase 3 credits (slightly greater than 3 acres) of wetlands from an offsite mitigation bank and restore 1 acre of salt marsh, resulting in a mitigation ratio of greater than 2.2 to 1 (more than 4 acres of wetlands gained to 1.8 acres lost). Both the COE and the FDEP approve of this mitigation plan.
Aquatic ecology, thermal effects	Thermal discharges would not be expected to have a measurable effect on the biota of the area because the maximum circulating flow rates, condenser temperature rises, and total area of the discharge plume that are currently limited under a National Pollutant Discharge Elimination System permit would be maintained. Bottom-dwelling organisms such as macroinvertebrates would not experience effects as a result of thermal discharges because the discharge plume is directed upward and is largely a surface phenomenon.
Aquatic ecology, entrainment and impingement	To mitigate impingement, a fish return system has been in operation at Northside Generating Station since the late 1970s. A 1994 study by the U.S. Environmental Protection Agency concluded that this system represents the best available technology for mitigating impingement.
Threatened and endangered species	The potential for manatees to be trapped and pinned between the dock and a vessel would be minimal because the dock would be supported by widely spaced support pilings rather than consisting of one long continuous structure. This design would allow sufficient space between vessels and the dock structure such that manatees could easily avoid being trapped.

Table 4.2.1. Continued

Environmental issue	Pollution prevention or mitigation measure
Threatened and endangered species (continued)	Prior to construction, a gopher tortoise survey would be conducted to identify burrows that must be manually excavated, and the animals would be relocated according to conditions of the collecting permit from the Florida Game and Freshwater Fish Commission. A few juvenile loggerhead, Kemps Ridley, and/or green sea turtles were observed swimming in the intake basin in 1997. To help prevent such future incidences, the intake trash racks were refitted with welded wire screens installed on 6-in. centers contrasted to the old 12-in. center grids. The closer grids ***have*** excluded turtles of sizes similar to those previously observed from entering the intake basin and becoming trapped.
Socioeconomics, traffic and noise	Noise, vibration, and blocked roads at on-grade rail crossings caused by trains transporting coal would be minimized by relying more heavily on barges and ships for coal transport. To reduce road congestion, JEA has agreed to encourage carpooling and suggest alternate routes to and from the site. JEA has also agreed to monitor traffic at the ***rear*** entrance to the site and ***to place a police officer at the intersection of Ostner and New Berlin Roads if necessary to reduce congestion during peak times. JEA also has agreed to*** pursue ***authorization*** of a temporary traffic signal ***at Ostner and New Berlin Roads if the presence of the police officer does not adequately control project-induced traffic.*** ***JEA has committed to installing mufflers if high-pressure steam blowouts are conducted or, if mufflers are not installed, has committed to measuring noise levels at the nearest residences to ensure that the levels would conform to noise ordinance limits.*** JEA has historically implemented a public awareness program (e.g., advance notification) regarding ***high-pressure*** steam blowouts and would do so during the proposed project, ***if necessary.*** JEA would also notify beforehand all residences within 0.5 mile of the high-***pressure*** steam cleaning operation. This advisory would alert people to go inside to reduce the effects of the noise. As a mitigation measure, only daytime ***high-pressure*** steam blowouts would be permitted and no Sunday ***high-pressure*** steam blowouts would be allowed.

Table 4.2.1. Concluded

Environmental issue	Pollution prevention or mitigation measure
Socioeconomics, traffic and noise (continued)	During pile driving, JEA would use an enclosure technology or a less noisy type of pile driving (e.g., the vibratory method), as necessary, to ensure that the daytime construction noise level would not exceed 65 dB(A) at the nearest residences.
	JEA would install baffle silencers for the fans of the proposed facility and enclose the coal and limestone crushers in a sound-insulating building to reduce noise levels during operation to comply with the city of Jacksonville noise ordinance level of 60 dB(A) at any residence.

regarding the economic advantages of marine transportation for delivering coal so that rail transport becomes the primary means of delivering any coal to be used). As a result, there would be fewer train trips through the neighborhoods in the vicinity of Northside Generating Station (under this scenario compared with the proposed project), which would reduce potential problems with noise, vibration, and blocked roads at on-grade rail crossings. Thus, neighborhood concerns regarding the proposed project could be lessened.

Under the second scenario, rather than repowering Unit 2, JEA could construct and operate a new gas-fired combined cycle facility at Northside Generating Station or at one of their other existing power plants. The natural gas would drive a gas combustion turbine, and the heat from combustion would be used to produce steam to drive a steam turbine. The facility would be expected to generate approximately 230 MW of electricity.

Construction activities and operations would be similar to the proposed project but with notable differences related to fuel, sorbent, and ash handling and storage facilities. Under this scenario, no coal, petroleum coke, limestone, or lime would be used. Because the natural gas would be delivered by pipeline and no sorbent would be used, there would be no train, ship, or truck traffic associated with fuel and sorbent delivery. No combustion ash would be generated and there would be no truck traffic to remove ash from the site. Consequently, community concerns related to traffic noise and disruptions would be minimized.

As discussed in Section 2.3.1, air emissions would be expected to increase compared with historical levels because of the operation of the combined cycle facility in addition to the existing Northside units operating at the same or higher capacity factors. Therefore, air emissions under this scenario would generally be greater than those for the proposed project. Changes in concentrations of pollutants in the ambient air would depend on the location and project-specific nature of the facility (e.g., stack height and exit temperature and velocity).

Although the size of the construction and operations workforce could be different than for the proposed facility, the difference would not be large enough to cause any noticeable socioeconomic or offsite land use impacts. These impacts likely would be the same for any site in the Jacksonville area. Traffic congestion during construction would depend on the project location. Compared to the proposed project, traffic congestion during the construction period could be reduced at Northside if a smaller workforce were required.

If a gas-fired combined cycle facility were constructed at Northside Generating Station, aesthetic impacts could vary slightly if its stack were a different height than the stack for the proposed project. However, the industrial nature of the project area makes it unlikely that any difference in aesthetic impacts would be substantial. Impacts to cultural resources could be less if there were less disruption to construct conveyors and other facilities on previously undisturbed land; conversely, impacts could be greater if more onsite and/or offsite land were disturbed because of a need to upgrade the pipeline supplying natural gas to the facility. If a gas-fired facility were constructed at another location, aesthetic and cultural impacts could be greater or less than at Northside Generating Station, depending on the nature of the site and the need to construct or upgrade a pipeline to supply natural gas to the facility.

Depending on the site, impacts to terrestrial ecological resources probably would be negligible because no solid fuel receiving and storage areas and no ash storage areas would be required. However, additional impacts might result from construction of an offsite pipeline to deliver natural gas. Depending on the site, ecological impacts to wetlands probably would be negligible. Floodplain impacts would be similar to those resulting from the proposed project. There would be no dredging activities that could temporarily affect water quality and mobilize contaminants.

Impacts resulting from electromagnetic fields would be similar to those resulting from the proposed project. The geographical distribution of impacts, if any, would be different if the facility were constructed at another site because the electricity would be transmitted on different transmission lines.

Under the third scenario, rather than repowering Unit 2, JEA could purchase electricity from other utilities to meet JEA's projected demand. Consequently, no construction activities or changes in operations would be expected to occur within the JEA system of power plants, including Northside Generating Station. There would be no change in current environmental conditions at the site, and the impacts would remain unchanged from the baseline conditions. It is possible that existing Units 1 and 3 might be required to operate at capacity factors greater than historical levels if JEA were unable to purchase sufficient electricity from other utilities. Consequently, annual air emissions and groundwater consumption might increase.

There could be construction activities or changes in operations at the other utilities providing electricity to JEA if the electricity were not readily available. Some impacts to resources could result in the geographical area of the other utilities, particularly if a new facility were built to meet the JEA demand or if additional fuel were transported to the other site or sites to generate additional electricity. The level of any such impacts would depend on the project-specific characteristics of any facility construction, the fuel required by the facility, and the affected resources in the area.